

A Social and Ecological Evaluation of Marine Mammal Take Reduction Teams

by

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Dissertation submitted in partial fulfillment of  
the requirements for the degree of  
Doctor of Philosophy in the Division of  
Marine Science and Conservation  
in the Graduate School  
of Duke University

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ABSTRACT

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## **Abstract**

There have been few efforts to evaluate the actual and perceived effectiveness of environmental management programs created by consensus-based, multi-stakeholder negotiation or negotiated rulemaking. Previous evaluations have used perceived success among participants as a proxy for actual effectiveness, but seldom have investigated the ecological outcomes of these negotiations. Fewer still, if any, have compared the actual and perceived outcomes. Here I evaluate and compare the social and ecological outcomes of the negotiated rulemaking process of marine mammal take reduction planning. Take reduction planning is mandated by the U.S. Marine Mammal Protection Act (MMPA) to reduce the fisheries-related serious injuries and mortalities of marine mammals (bycatch) in U.S. waters to below statutory thresholds. Teams of fishermen, environmentalists, researchers, state and federal managers, and members of Regional Fisheries Management Councils and Commissions create consensus-based rules to mitigate bycatch, called Take Reduction Plans. There are six active Take Reduction Plans, one Take Reduction Strategy consisting of voluntary measures, and one plan that was never implemented. It has been 20 years since marine mammal take reduction planning was incorporated into the MMPA. Early evaluations were promising, but identified several challenges. In the past decade or more, the National Marine Fisheries Service (NMFS) has implemented measures to set up the teams for success.

I used data from formal Stock Assessment Reports to assess and rank the actual ecological success of five Take Reduction Plans (Harbor Porpoise, Bottlenose Dolphin, Atlantic Large Whale, Pelagic Longline, and Pacific Offshore Cetacean) in mitigating the bycatch of 17 marine mammal stocks. In addition, I employed social science data collection and analytical methods to evaluate Take Reduction Team participants' opinions of the take reduction negotiation process, outputs, and outcomes with respect to the ingredients required for successful multi-stakeholder, consensus-based negotiation (team membership, shared learning, repeated interactions, facilitated meetings, and consensus-based outputs). These methods included surveying and interviewing current and former Take Reduction Team participants; using Structural Equation Models (SEMs) and qualitative methods to characterize participant perceptions across teams and stakeholder groups; and identifying and exploring the reasons for similarities and differences among respondents, teams, and stakeholder groups. I also employed SEMs to quantitatively examine the relationship between actual and perceived ecological success, and contrasted actual and perceived outcomes by comparing their qualitative rankings.

Structural Equation Models provided a valid framework in which to quantitatively examine social and ecological data, in which the actual ecological outcomes were used as independent predictors of the perceived outcomes. Actual improvements in marine mammal bycatch enhanced stakeholder opinions about the

effectiveness of marine mammal Take Reduction Plans. The marine mammal take reduction planning process has all of the ingredients necessary for effective consensus-based, multi-stakeholder negotiations (Chapter 2). It is likely that the emphasis that the National Marine Fisheries Service places on empirical information and keeping stakeholders informed about bycatch, marine mammal stocks, and fisheries facilitated this relationship. Informed stakeholders also had relatively accurate perceptions of the actual ecological effectiveness of the Take Reduction Plans (Chapter 3). The long timeframes over which the teams have been meeting generally have increased cooperation. The professionally trained, neutral facilitators have produced fair negotiations, in which most individuals felt they had an opportunity to contribute. Participant views of fairness significantly influenced their satisfaction with Take Reduction Plans, which significantly affected their perceptions about the effectiveness of those plans (Chapter 2). The mandate to create a consensus-based output has, for the most part, minimized defections from the negotiations and facilitated stakeholder buy-in.

In general, marine mammal take reduction planning is a good negotiated rulemaking process, but has produced mixed results (Chapters 1 and 2). Successful plans were characterized by straightforward regulations and high rates of compliance. Unsuccessful plans had low compliance with complex regulations and sometimes focused on very small stocks. Large teams and those in the northeastern U.S. (Maine to

North Carolina) were least successful at reducing bycatch, which was reflected in stakeholder views of the effectiveness of these teams. Take Reduction Team negotiations have not always produced practical or enforceable regulations. Implementation of take reduction regulations is critical in determining plan success and identifying effective mitigation measures, but because of a lack of monitoring, has not been characterized consistently across most teams. Additionally, elements like the “Other Special Measures Provision” in the Harbor Porpoise Take Reduction Plan have undermined the negotiation process by allowing the National Marine Fisheries Service to alter consensus-based elements without consensus from the team, which has led to hostility, mistrust, and frustration among stakeholders.

The final chapter of this dissertation provides recommendations to improve the outcomes and make them more consistent across teams. I based these recommendations on the information gathered and analyzed in the first three chapters. They are grouped into four broad categories - team membership, social capital, fairness, and plan implementation. If the National Marine Fisheries Service implements these suggestions, both perceived and actual ecological effectiveness of marine mammal Take Reduction Teams should improve, allowing these teams to fulfill their maximum potential.

## **Dedication**

For my husband, Trey, my carpenter, mechanic, sugar daddy, partner, and best friend. Thank you for allowing me to uproot our family to accomplish this life goal. I share this degree with you and I love you. And for our beloved Beavis. Wherever he is, I hope he's lost in a scent, lying in the sun, or eating a loaf of bread.



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# **1. Chapter 1: Evaluating a Negotiated Rulemaking Process: Do Marine Mammal Take Reduction Plans Reduce Bycatch?**

## ***1.1 Introduction***

The tradeoffs between the conservation and allocation of natural resources have historically engendered conflict. These conflicts are exacerbated by several challenges: ecosystem complexity and uncertainty; wide-ranging, deep-core beliefs of affected parties; confounding jurisdictional authorities; politics; and long timeframes over which they occur, leading to intractable or ‘wicked’ problems (Balint et al., 2011; Dukes, 2005; Nie, 2003). Environmental disputes often revolve around common pool resources in which the public shares the costs of exploiting the resource, but only a few resource-users reap the benefits of such exploitation – i.e., the Tragedy of the Commons (Hardin, 1968). In the 1970s, the U.S. government enacted a variety of command and control style environmental statutes to address environmental problems by targeting pollution and protecting species. Under some circumstances this approach has protected natural resources and allocated access rights, but it has been criticized as a means of resolving environmental conflict and supporting decision-making.

Multi-stakeholder, consensus-based rulemaking (negotiated rulemaking) can improve the quality of decision-making by incorporating public values, resolving conflicts among opposing coalitions, building trust in institutions, and educating the

public (Beierle, 2002; Beierle and Cayford, 2002). Moreover, this approach can enhance acceptance of regulations, which can then increase the likelihood of compliance (Coglianese, 1997; Holmes and Scoones, 2000; Newig, 2007). Previous evaluations of environmental stakeholder negotiations have focused on process, stakeholder perceptions, impacts on litigation, and time-saving (Coglianese, 1997; Leach et al., 2002), with a particular emphasis on participant satisfaction with the process. These criteria can be good predictors of participant satisfaction with the outcomes, but they may not reflect the ecological outcomes (Coglianese, 2003; Dukes, 2005; Leach et al., 2002; Moore, 1996). In fact, environmental policy research has been criticized for focusing on process measures rather than environmental outcomes (Koontz and Thomas, 2006; Niles and Lubell, 2012).

Without a formal evaluation of the effectiveness of environmental interventions, practitioners may not only waste time and resources (in the case of ineffective measures), but the unintended consequences of such interventions may cause more harm than good (Koontz and Thomas, 2006; Pullin and Knight, 2009; Weiss, 1972). The cost of multi-stakeholder negotiations also emphasizes the need for regulators to determine their effectiveness (Newig, 2007). In addition, feedback regarding ecological outcomes of environmental management is the cornerstone of adaptive management. Despite these compelling reasons, ecological evaluation of conservation management is

in the early stages (Pullin and Knight, 2009), and has not explicitly considered the impacts of participatory processes (Brogden, 2003; Newig, 2007).

There are several challenges to conducting such evaluations. First, a monitoring program is required prior to establishing any environmental intervention to provide a baseline against which to measure impacts (Brogden, 2003; Koontz and Thomas, 2006; Newig, 2007; Pullin and Knight, 2009). Often such baseline data do not exist, or if they do, are not readily accessible. Second, stakeholder groups must clearly define measurable objectives that can be used for future evaluation (Dukes, 2005; Newig, 2007; Weiss, 1972). Third, to account for environmental variability, monitoring must occur over long time scales, which can be expensive (Brogden, 2003; Koontz and Thomas, 2006). Finally, ecosystem complexity and the possibility of multiple, simultaneous interventions make it difficult to attribute a change in environmental conditions to any particular intervention (Brogden, 2003; Koontz and Thomas, 2006; Newig, 2007).

### **1.1.1 Case Study**

The Marine Mammal Protection Act of 1972 (MMPA, 16 U.S.C. 1361 et seq.) is the only U.S. environmental statute that requires a negotiated rulemaking process to address a specific environmental problem – the incidental mortality of marine mammals in fisheries, termed bycatch. Marine mammal populations are vulnerable to bycatch because of their life history characteristics and demography (Lewison et al., 2004; Read,



2008; Read et al., 2006; Soykan et al., 2008). They have long lifespans, late ages of maturity, low fecundity, and high survival rates (Heppell et al., 2000; Heppell et al., 2005) and, consequently, are vulnerable to even moderate rates of mortality (Heppell et al., 2000; Heppell et al., 2005; Lewison et al., 2004). High bycatch rates can cause marine mammal populations to decline over very short timeframes (Lewison et al., 2004; Taylor et al., 2000; Wade, 1998).

For small populations of marine mammals, bycatch can be particularly pernicious (Lewison et al., 2004; Read, 2008). Even rare bycatch events can dramatically affect population viability, especially if mortality impacts reproductively active females (Read and Wade, 2000). In a large fishery, each fisherman's contact with such animals may be extremely rare, so protective measures can be both expensive and politically unpopular (Read, 2008).

Here I present a case study in which I evaluate the ecological outcomes of the negotiated rulemaking process implemented to reduce marine mammal bycatch in U.S. waters through the development of Take Reduction Plans. This research augments prior work that evaluates perceived success of stakeholder negotiation processes by focusing on quantifying ecological success. Geijer and Read (2013) describe an overall decline in marine mammal bycatch in the U.S. since the implementation of these plans, suggesting that they have been generally successful in reducing the scale of bycatch in the U.S. This approach builds on this analysis by comparing ecological outcomes to the criteria

mandated under the MMPA. I create a simple, objective method to evaluate the ecological effectiveness of several plans by comparing their outcomes to statutory mandates. By examining the history and attributes of each plan, I also propose a suite of factors that may contribute to their ecological outcomes. Finally, I demonstrate how this method can be used to prioritize marine mammal stocks that are not regulated through this process, but may require regulatory intervention.

## **1.2 Methods**

### **1.2.1 Case Study Background**

The National Marine Fisheries Service (Service) is charged with protecting cetaceans and most species of pinnipeds in the U.S. by implementing conservation measures mandated in the MMPA. A unique feature of the MMPA is the formula for estimating the maximum allowable number of animals that can be removed from a stock by human-related causes without causing depletion or impeding recovery, called the Potential Biological Removal (PBR). PBR is calculated as the product of the minimum estimate of the population size ( $N_{\min}$ ), one-half of the maximum potential population growth rate ( $R_{\max}$ ), and a recovery factor ( $F_r$ ), which considers the status of a population and addresses uncertainty caused by biases in mortality, abundance, and  $R_{\max}$ . If bycatch of a stock exceeds PBR, the stock is deemed “strategic” (16 U.S.C. 1361(19)). The “strategic” designation includes stocks listed as endangered or threatened under the

Endangered Species Act, depleted under the MMPA, or that are declining and likely to become endangered or threatened (16 U.S.C. 1362 (19)).

Under Section 118 of the MMPA, the Service must compile a list of commercial fisheries each year based on the frequency and severity of their interactions with marine mammals: Category I (frequent incidental mortality or serious injury); Category II (occasional); and Category III (remote likelihood). The Service prepares Stock Assessment Reports for each stock of cetaceans and pinnipeds (except walruses) that contain information on population structure, abundance, trends, and the extent of human-caused mortality (16 U.S.C. 1387(d)). Regional scientific review groups provide peer-review of the Stock Assessment Reports and make recommendations about research priorities (Read and Wade, 2000; Taylor et al., 2000). If a “strategic” stock interacts with a Category I or II fishery, the Service is required to form a multi-stakeholder group of fishermen, researchers, environmentalists, and state and federal managers, known as a Take Reduction Team (16 U.S.C. 1387(f)(6)(A)(i)).

Each team must create a consensus-based suite of regulations called a Take Reduction Plan (16 U.S.C. 1387(f)(7)(A)(ii)). The immediate goal of each plan is to reduce bycatch to below PBR within the first six months of implementation (16 U.S.C. 1387(f)(2)). The long-term goal is to reduce bycatch to levels approaching a zero mortality and serious injury rate, termed a “zero mortality rate goal” (ZMRG), which is defined as 10% of PBR (50 CFR §229). If the team does not reach consensus, the Service

must draft a plan that incorporates any consensus-based elements, pursuant to 16 U.S.C. 1387(f)(7)(A)(ii).

### **1.2.2 Data**

There are seven active Take Reduction Teams (teams): Atlantic Large Whale; Atlantic Trawl Gear; Bottlenose Dolphin; False Killer Whale; Harbor Porpoise; Pacific Offshore Cetaceans; and Pelagic Longline (<http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm#gmhp>). The Atlantic Offshore Cetaceans team disbanded because the fisheries it addressed were closed by regulation.

I extracted data from marine mammal Stock Assessment Reports from 1989 to 2013 (<http://www.nmfs.noaa.gov/pr/sars/species.htm>) for the 17 stocks that are managed under a Take Reduction Plan, and compiled information on annual bycatch, PBR, ZMRG, and abundance. For the stocks identified by the U.S. Government Accountability Office (GAO, 2008) as requiring intervention, but for which a team has not yet been convened, I used the most recent decade of Stock Assessment Report data. The methods used to collect and analyze these data are described by Geijer and Read (2013).

### **1.2.3 Established Plans**

I used two metrics to estimate the effectiveness of each plan relative to MMPA goals and to each other. The first metric was a simple determination of whether or not each plan was successful irrespective of statutory deadlines, i.e. were mortality levels

reduced and maintained below PBR or ZMRG. I chose not to use the statutory deadlines because they have been characterized as unrealistic (GAO, 2008; RESOLVE, 1999; Young, 2001). Moreover, ecosystem unpredictability and inter-annual variation in fishing effort may cause bycatch to fluctuate annually and, although bycatch might drop below PBR within six months (or ZMRG in five years), it may exceed PBR or ZMRG in subsequent years (GAO, 2008). Conversely, establishing regulations that reduce bycatch often requires a period longer than six months. Thus, it is more relevant to ask whether bycatch was maintained at levels below PBR or ZMRG once achieved than to determine whether statutory deadlines were met. Metric 1 is thus a simple categorical measure of whether or not bycatch was reduced and maintained below PBR or ZMRG as follows:

0 = Bycatch >PBR

1 = Bycatch <PBR and >ZMRG, and remained there through 2011

2 = Bycatch <ZMRG, and remained there through 2011

Stocks where bycatch fluctuated above and below ZMRG were assigned a score of 1, while stocks that fluctuated above and below PBR were assigned a 0. Ranks of all stocks managed under a single plan were averaged to determine a mean rank. I excluded stocks that were below ZMRG prior to implementing a plan.

Metric 2 was the mean of the annual difference in bycatch from PBR divided by PBR itself.

$$\text{Metric 2} = \text{mean}[(\text{PBR}-\text{Bycatch})/\text{PBR}]$$

such that: 1.00 implies No bycatch

0.90–0.99 implies  $\leq$ ZMRG (because ZMRG = 10% of PBR)

0.00–0.89 implies  $>$ ZMRG and  $\leq$ PBR

$<0.00$  implies  $>$ PBR

Ranks of all stocks managed under a single plan were averaged to determine mean rank and, as above, I excluded stocks that were below ZMRG prior to implementation of a plan.

For both metrics, higher ranks indicated greater success. I calculated ranks for the following plans: Harbor Porpoise, Atlantic Large Whale, Pelagic Longline, and some stocks managed under the Bottlenose Dolphin and Pacific Offshore Cetaceans plans. Unfortunately, I was unable to rank several stocks and teams. For example, bycatch levels for all stocks considered by the Atlantic Trawl Gear team are below PBR, none of the stocks are strategic, nor do they interact with any Category I fisheries. This team was created as the result of a lawsuit brought by environmental groups (N.D. Cal. Apr. 30, 2003). In this case, the statutory deadlines do not apply (National Marine Fisheries Service, 2008). Furthermore, this team created a Take Reduction Strategy rather than a Plan, which is restricted to voluntary measures involving education, outreach, and research (National Marine Fisheries Service, 2008, 2012a). Secondly, the stocks considered by the Bottlenose Dolphin Team were redefined in 2010 and data were available for only a few of the newly defined stocks. The Northern and Southern Coastal

Migratory Stocks of bottlenose dolphins are not strategic but were included in the analyses because bycatch exceeded ZMRG when the team was created. Moreover, these stocks are susceptible to periodic, large-scale, unusual mortality events that can decrease abundance and lower PBR. One such event began in July 2013 and continues at the time of writing. In addition, the Stock Assessment Reports for these stocks described bycatch levels in terms of minimum and maximum potential values due to uncertainty regarding the stock identity of dolphins taken as bycatch in gillnet fisheries. Thus, I conducted separate rankings with these minimum and maximum values. The primary fisheries considered by the Atlantic Offshore Cetaceans Team have been closed, making the plan irrelevant. Finally, the False Killer Whale plan has not been implemented long enough to calculate ranks for its stocks.

#### **1.2.4 Covariates**

I gathered information about each team that I hypothesized could influence the ecological outcome for each stock. These included the following (Table 1): team size (members plus alternates); team age (months); PBR in 2011 for each stock (averaged for each plan); the number of amendments to each plan; and geographic region of the team/stocks.

To determine whether any covariates significantly affected these results, I conducted a multiple regression analysis of the ecological ranks (metrics 1 and 2) on the

independent variables of PBR, U.S. geographic region, and Take Reduction Team size and age using Mplus (Muthén and Muthén, 1998-2010).

**Table 1: Covariates of Take Reduction Teams and marine mammals stocks that may contribute to their ecological success.**

Take Reduction Team and Affiliated Marine Mammal Stock	PBR in 2011	Team Size (number of members + alternates)	Team Age (Months)	Number of Take Reduction Plan Amendments	U.S. Geographic Region
<b>Atlantic Large Whale</b>	3.1 (average of team stocks)	82	221	28	<b>Northeast</b>
Western North Atlantic Right Whale	0.9				
Gulf of Maine Humpback Whale	2.7				
Western North Atlantic Fin Whale	5.6				
<b>Bottlenose Dolphin</b>	39.6 (average of team stocks)	46	158	2	<b>Southeast</b>
*Western North Atlantic, Coastal, Northern Migratory	86				
*Western North Atlantic, Coastal, Southern Migratory	63				
Northern North Carolina Estuarine System	7.9				
Southern North Carolina Estuarine System	1.6				
<b>Harbor Porpoise</b>	625	42	227	2	<b>Northeast</b>
Gulf of Maine-Bay of Fundy Harbor Porpoise					
<b>Pacific Offshore Cetacean</b>	45.8 (average of team stocks)	17	227	2	<b>West</b>
California/Oregon/Washington Sperm Whale	1.5				
California/Oregon/Washington Short-finned Pilot Whale	4.6				
California/Oregon/Washington Humpback Whale	11				
California/Oregon/Washington Northern Right Whale Dolphin	48				
California/Oregon/Washington Long-beaked Common Dolphin	164				
<b>Pelagic Longline</b>	143 (average of team stocks)	26	115	0	<b>Southeast</b>
Western North Atlantic Risso's Dolphin	126				
Western North Atlantic Long- and Short-finned Pilot Whale	159				



### 1.2.5 Unclassified Stocks

The Government Accountability Office (GAO, 2008) identified several marine mammal stocks that are not currently managed under a Take Reduction Plan, but warrant intervention. I used a similar two-step approach to rank these stocks where low scores indicated a high priority for plan creation. The first metric used the statutory criteria for forming a team and prioritizing stocks when agency funding is limited (16 U.S.C. 1387(f)(1) and (3)). I excluded the criterion for “small population size” because “small population” is not defined in the statute and would likely depend on species-specific demographics. The second metric employed the method described above (average annual difference between bycatch and PBR divided by PBR).

Bycatch of these stocks was below PBR for the 10 years I examined and, with the exception of Western North Atlantic beaked whales; all stocks were “strategic.” Metric 1 was calculated as the sum of the following factors: whether the stock was “strategic;” whether the stock interacted with a Category I or II fishery; abundance trend; whether the stock was <ZMRG in the most recent Stock Assessment Report; and proportion of years that bycatch was < ZMRG.

$$\text{Metric 1} = (\text{strategic?}) + (\text{fisheries interactions}) + (\text{abundance trend}) + (< \text{ZMRG}) + (n<\text{ZMRG}/10)$$

where: If the stock is strategic = -1 , if no = 0

Fisheries interactions =

$$[(\# \text{ Category I fisheries}) \times (-1)] + [(\# \text{ Category II fisheries}) \times (-0.5)]$$

Abundance trend: increasing = 1, decreasing = -1, unknown or stable = 0

< ZMRG: if the most recent bycatch is < ZMRG = 1, if no = 0

n<ZMRG: # years where bycatch < ZMRG

## **1.3 Results**

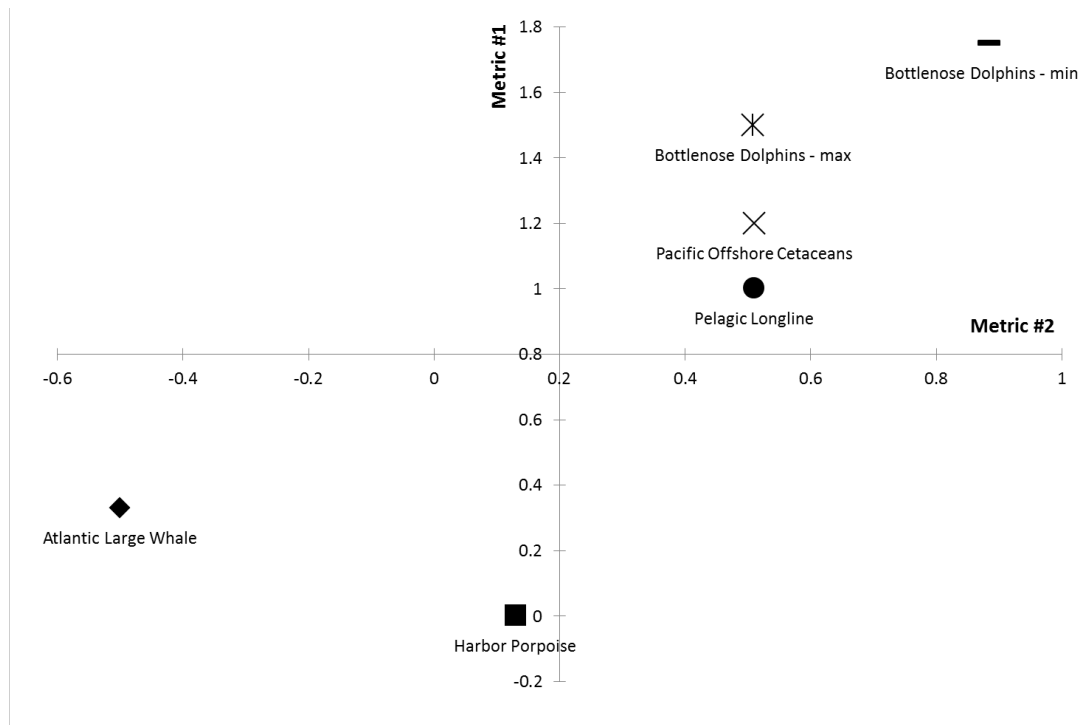
### **1.3.1 Existing Plans**

The five plans I assessed deal with 17 marine mammal stocks. Ranks for Metric 1 ranged from 0 to 1.75 while ranks for Metric 2 ranged from -0.5 to 0.89 (Figures 1 and 2, Table 2). The two lowest ranking plans (Harbor Porpoise and Atlantic Large Whale) had Metric 1 scores less than 0.5, and the latter had a negative value for Metric 2 (Figures 1 and 2, Table 2), indicating that average annual bycatch fluctuated above and below PBR and far exceeded ZMRG.

**Table 2: Metric 1 and 2 ranks of marine mammal Take Reduction Plans and stocks.**

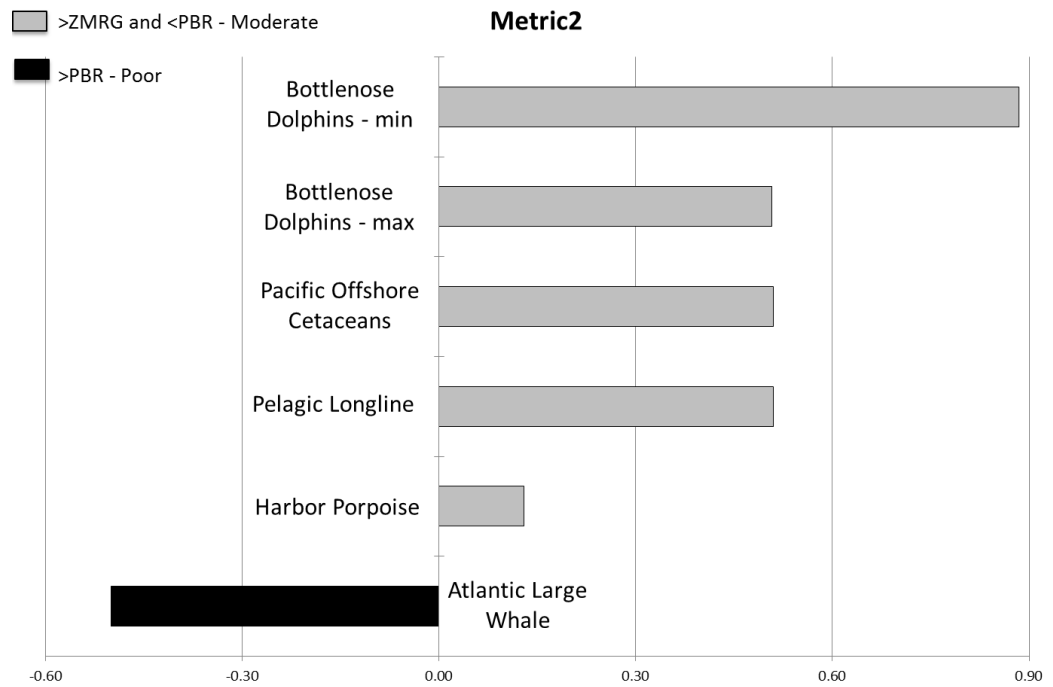
Take Reduction Team	Marine Mammal Stock	Metric 1	Metric 2
		Rank	average[(PBR-BC)/PBR] Interpretation of M2
Harbor Porpoise	Gulf of Maine-Bay of Fundy Harbor Porpoise	0	0.13 <PBR and >ZMRG
Atlantic Large Whale	---	0.33	-0.50 >PBR
	Western North Atlantic Right Whale	0	-0.94 > PBR
	Gulf of Maine Humpback Whale	0	-1.41 >PBR
	Western North Atlantic Fin Whale	1	0.84 <PBR and >ZMRG
Pacific Offshore Cetaceans	---	1.20	0.51 <PBR and >ZMRG
	California/Oregon/Washington Short-finned Pilot Whale	2	0.54 <PBR and >ZMRG
	California/Oregon/Washington Sperm Whale	0	-0.28 >PBR
	California/Oregon/Washington Humpback Whale	1	0.51 <PBR and >ZMRG
	California/Oregon/Washington Long-beaked Common Dolphin	2	0.87 <PBR and >ZMRG
	California/Oregon/Washington Northern Right Whale Dolphin	1	0.90 = ZMRG
Bottlenose Dolphin - minimum bycatch estimate	---	1.75	0.89 <PBR and >ZMRG
	*Western North Atlantic, Coastal, Northern Migratory	2	0.96 <ZMRG
	*Western North Atlantic, Coastal, Southern Migratory	2	0.96 <ZMRG
	Northern North Carolina Estuarine System	1	0.76 <PBR and >ZMRG
	Southern North Carolina Estuarine System	2	0.86 <PBR and >ZMRG
Bottlenose Dolphin - maximum bycatch estimate	---	1.50	0.51 <ZMRG
	*Western North Atlantic, Coastal, Northern Migratory	2	0.93 <ZMRG
	*Western North Atlantic, Coastal, Southern Migratory	2	0.74 <PBR and >ZMRG
	Northern North Carolina Estuarine System	1	-0.15 >PBR
	Southern North Carolina Estuarine System	1	0.51 < PBR and > ZMRG
Pelagic Longline	---	0.50	0.51 <PBR and >ZMRG
	*Western North Atlantic Long- and Short-finned Pilot Whale	0	0.07 <PBR and >ZMRG
	*Western North Atlantic Risso's Dolphin	1	0.94 <ZMRG

\*stocks NOT strategic prior to TRT

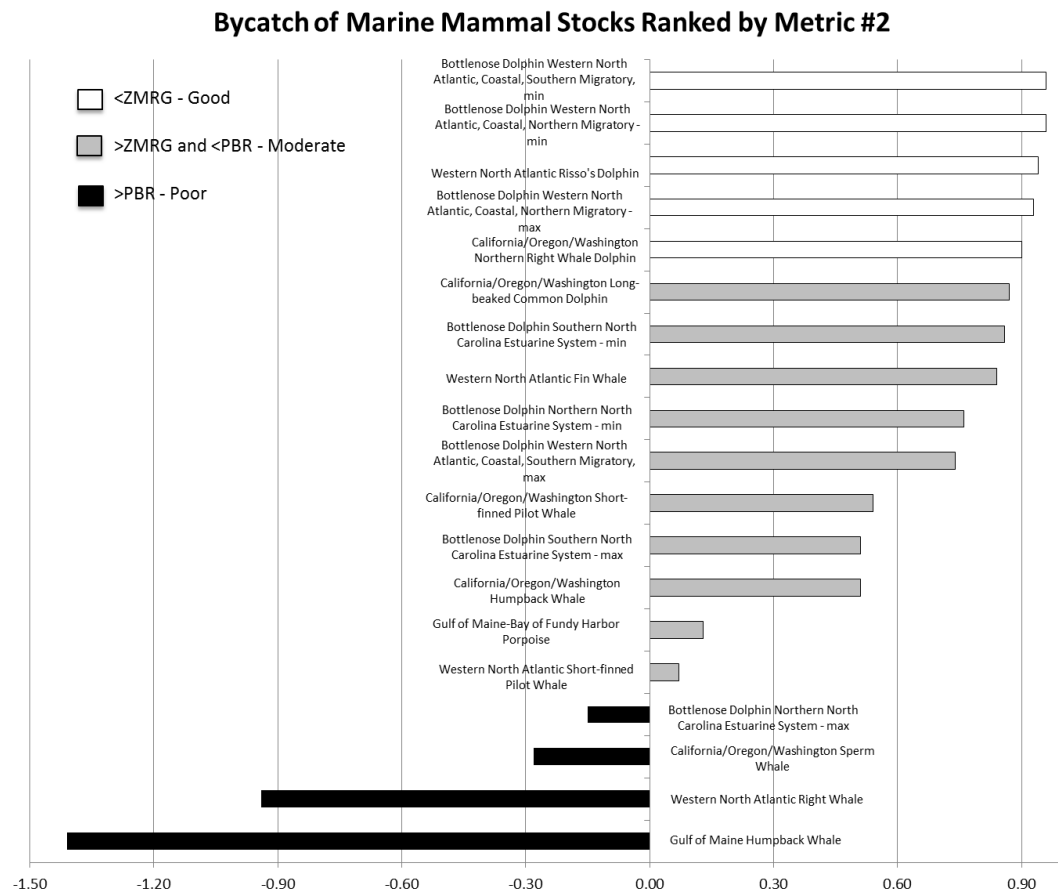


**Figure 1: Rank scores of marine mammal Take Reduction Plans, Metric 1 by Metric 2.**

The most successful plans (Bottlenose Dolphin and Pacific Offshore Cetaceans) scored greater than 1.0 for the first Metric and above 0.5 for Metric 2 (Figures 1 and 2, Table 2). These plans reduced and sustained bycatch across stocks to below PBR, and at least two stocks from each maintained bycatch below ZMRG. The high, positive Metric 2 values indicate average annual bycatch was below PBR, and one was nearly at ZMRG (Figure 2).



**Figure 2: Ranks for Metric 2 of marine mammal Take Reduction Plans. Black (<0)= high bycatch (>PBR) and gray (0–0.89) = moderate bycatch (>ZMRG and <PBR).**



**Figure 3: Ranks for Metric 2 of 17 marine mammal stocks managed by Take Reduction Plans. Black ( $<0$ )= high bycatch ( $>PBR$ ) gray (0–0.89) = moderate bycatch ( $>ZMRG$  and  $<PBR$ ), and white ( $\geq 0.9$ ) = low bycatch ( $\leq ZMRG$ ).**

For individual stocks, scores for Metric 1 were classified as 0, 1, or 2. Values for Metric 2 ranged from  $-1.41$  to  $0.96$  (Figure 3, Table 2). Five stocks (Gulf of Maine humpback and North Atlantic right whales, California/Oregon/Washington sperm whales, Gulf of Maine-Bay of Fundy harbor porpoises, and Western North Atlantic long- and short-fin pilot whales) scored zero for Metric 1, indicating they were above PBR or fluctuated above and below PBR. Three of those stocks (humpback, right, and sperm

whales) had negative values for Metric 2, indicating that average annual bycatch exceeded PBR. The Northern North Carolina Estuarine Stock of bottlenose dolphins (maximum bycatch estimate) also scored negatively for Metric 2 (Figure 3). Harbor porpoises and pilot whales, meanwhile scored under 0.5 for Metric 2. Sperm whale bycatch was below ZMRG for nine of 13 years. However, in 2010, it experienced very high bycatch (16 animals), dramatically affecting its average annual difference from PBR.

Based on Metric 1, management of four stocks can be considered a success, with scores of 2 (bycatch below ZMRG). Two of these four are managed under the Pacific Offshore Cetaceans plan and two are covered under the Bottlenose Dolphin plan (Table 2). Bycatch of Pacific short-finned pilot whales was below PBR and ZMRG for all but one-implementation years. Bycatch of the two-bottlenose dolphin stocks also was below ZMRG for all years but one, while that of long-beaked common dolphins was below ZMRG for more than 70% of the years following implementation. Five stocks scored 0.9 or above for Metric 2, indicating their average annual bycatch was at or below ZMRG (Figure 3). Bycatch of all five stocks was below PBR when their teams were formed and for all stocks except the Northern right whale dolphin, was below ZMRG for more than half of the implementation period.

### 1.3.2 Covariates

Team size ranged from 17 to 82 members, including alternates (Table 1). The Atlantic Large Whale Team is the largest and Pacific Offshore Cetaceans the smallest. The youngest team was established in June 2005 and the oldest two teams were formed in February 1996. Most plans have been amended a few times; the Atlantic Large Whale plan has been amended 28 times. Mean PBR of each team also varies greatly, ranging from 3.1 to 625. The Western North Atlantic right whale has the lowest individual PBR (0.9) and the Gulf of Maine-Bay of Fundy harbor porpoise stock has the highest (625).

The northeastern U.S. was a significant covariate of Metrics 1 and 2 with a negative regression coefficient (Table 3), which indicates that plans to regulate stocks in the northeastern U.S. (Maine to North Carolina) were less successful at reducing bycatch than plans created by teams in other regions (Table 3). The covariate for the northeast accounted for 85% of the variance in Metric 1 and 76% of the variance in Metric 2.

**Table 3: Regression coefficients for the covariate predictor (northeast U.S.) of Metrics 1 and 2.**

Dependent Variable	Covariate	Estimate	P-value	R <sup>2</sup>
Metric 1	NE U.S.	-1.11	0.000	0.85
Metric 2		-0.76	0.000	0.76



### **1.3.3 Unclassified Stocks**

I identified two stocks for which plans are needed (GAO 2008) but have not been created. Stocks with the two lowest scores for Metric 1, Western U.S. Steller sea lions (-5.0) and Central North Pacific humpback whales (-4.5) interact with several Category I or II fisheries (Table 4). The stock with the lowest ranks for Metric 2, the Western North Pacific humpback whale (0.74), had the lowest abundance estimate (938) and its average annual bycatch exceeded ZMRG (Table 4).

**Table 4: Metric 1 and 2 ranks of stocks identified by the GAO (2008) as requiring Take Reduction Teams and Plans, SI/M = serious injury and mortality.**

<b>Marine Mammal Stock</b>	<b>Total Metric 1</b>	<b>Metric 2</b>	<b>Interpretation of Metric 2</b>
<b>Western North Atlantic Mesoplodont beaked whales</b>	0.9	0.96	<ZMRG
<b>Central North Pacific humpback whale</b>	-4.5	0.88	>ZMRG and <PBR
<b>Western North Pacific humpback whale</b>	-1.4	0.74	>ZMRG and <PBR
<b>Hawaii sperm whale</b>	-0.1	0.97	<ZMRG
<b>Western North Atlantic Cuvier's beaked whale</b>	0.9	0.97	<ZMRG
<b>*Bering Sea harbor porpoise</b>	-0.5	0.9996	<ZMRG
<b>*Gulf of Alaska harbor porpoise</b>	-1.7	0.97	<ZMRG
<b>Southeast Alaska harbor porpoise</b>	-0.7	0.95	<ZMRG
<b>Eastern North Pacific northern fur seal</b>	-2.5	1.00	<ZMRG
<b>Eastern U.S. Steller sea lion</b>	1.5	0.98	<ZMRG
<b>Western U.S. Steller sea lion</b>	-5.0	0.89	>ZMRG and <PBR
<b>Gulf of Mexico, Northern coastal bottlenose dolphin</b>		SI/M unk; data deficient	
<b>Gulf of Mexico, bay, sound, estuary bottlenose dolphin</b>		SI/M unk; data deficient	

\*Abundance estimate > 8 years old

Stocks with highest scores for Metric 1 included Western North Atlantic Cuvier's and Mesoplodont beaked whales (0.9), which do not interact with any Category I or II

fisheries, and the Eastern U.S. stock of Steller sea lions (1.5), which interact with only one Category II fishery (Appendix). Stocks with highest ranks for Metric 2, Eastern North Pacific northern fur seals and the Bering Sea harbor porpoises, had the two of the three highest abundance estimates.

## **1.4 Discussion**

This analysis suggests that performance of this negotiated rulemaking process has been uneven. The Pacific Offshore Cetaceans and Bottlenose Dolphin plans were successful in meeting at least one statutory goal (reducing bycatch below PBR or ZMRG) and maintaining these reduced bycatch levels. Following implementation, their average annual bycatch was consistently below PBR and periodically below ZMRG. The Harbor Porpoise and Atlantic Large Whale plans did not result in reduced bycatch levels. For both plans, bycatch was below PBR for only half of the years following implementation and was rarely below ZMRG. This variability in ecological success also was reflected in the rankings of individual stocks. Nine of the 17 stocks can be considered successfully managed, with Metric 1 scores  $\geq 1$  and high ranks for Metric 2 ( $> 0.7$ ). Five of these stocks had average annual bycatch levels below ZMRG (Metric 2  $\geq 0.9$ ). Management of bycatch was unsuccessful for five stocks. Average bycatch for four of these five stocks was above PBR (Metric 2  $< 0$ ). Average bycatch of the remaining three stocks ranged between PBR and ZMRG.

### **1.4.1 Covariates**

The longevity of a plan affected the availability of data for this analysis, but did not affect success. Three plans were formulated in the mid-1990s but had widely varying degrees of success (Table 1). Team size, however, did appear to influence the success of a plan. As group size increases, trust among participants and the likelihood of achieving consensus decreases, participant perceptions of outcome efficiency and equity also decreases, as well as the likelihood of compliance with a consensus-based agreement (Dukes, 2005; Floyd et al., 1996; Holmes and Scoones, 2000; Leach, 2006; Leach and Sabatier, 2005; Sipe, 1998). The MMPA only stipulates the stakeholder groups that should be included, and does not restrict the number of participants

Teams dealing with stocks in the northeastern U.S. were less successful than those in other regions. This points to the importance of compliance with and enforceability of regulations. For example, the Harbor Porpoise plan (in the northeastern U.S.) requires the use of acoustic alarms, called pingers, in certain times and areas. When used properly, these devices can reduce harbor porpoise bycatch by more than 90% (Bache, 2001; Cox et al., 2007; Hardy et al., 2012; Palka et al., 2008). Fisheries observers monitor compliance with plan measures by recording information about the gear, catch, and bycatch when nets are retrieved. In 2010 and 2011, Orphanides and Palka (2012) estimated that only 41% of observed hauls were in compliance with pinger regulations in the Gulf of Maine. Moreover, Palka et al. (2012) documented only 19% compliance

with other gear requirements in the mid-Atlantic between 2010 and 2012. Geijer and Read (2013) found that harbor porpoise bycatch prior to implementation of the plan was directly correlated with cod landings in the northeast sink gillnet fishery. There was a partial de-coupling of the two parameters after the plan was implemented until 2007, indicating that measures in the plan were successful in reducing harbor porpoise bycatch. However, from 2008-2012, once again, there was a high correlation between cod landings and bycatch ( $r = 0.96$ ,  $p = 0.008$ ). This suggests that a lack of compliance with pinger requirements rendered the plan less effective and that variation in fishing effort was driving bycatch levels. Moreover, recent efforts by fishing industry members to lobby a National Marine Fisheries Service political appointee were successful in altering plan regulations and thus undermining the negotiation process (Safina and Read, 2012).

In contrast, compliance with the Pacific Offshore Cetaceans plan (western U.S.) was very good. Between 1998 and 2009, Carretta and Barlow (2011) documented that more than 99% of observed sets in the California drift gillnet fishery used pingers correctly. In addition, there is 20% observer coverage in the California/Oregon drift gillnet fishery and at least 50% of unobservable vessels are boarded at sea each year (Long and Fahy, 2012). This relatively high level of observer coverage provides precise estimates of bycatch, and a conspicuous enforcement presence deters violations of plan regulations. The reasons for the large difference in compliance between the two plans are not understood and are certainly worthy of further study.

In addition, although not statistically significant, poor performance of Take Reduction Plans in the northeastern U.S. also appeared to be associated with low stock sizes, broad scope of the plan, difficulty reaching consensus, and participants who undermined negotiations. For example, the enormous scope and scale of the Atlantic Large Whale Team makes it impractical to monitor compliance with an observer program. Moreover, the team has never reached consensus, which has confounded the purpose of negotiated rulemaking and increased the likelihood that the negotiating parties would go outside of the process to achieve their goals (Coglianese, 1997; Funk, 1997). This plan has spawned five lawsuits and Congressional intervention (Asmutis-Silvia, 2009; Asmutis-Silvia and Young, 2010). Moreover, the Atlantic Large Whale plan focuses on bycatch from very small, endangered stocks that have very low PBR values. Perhaps as a result, the team has produced myriad, convoluted amendments to the plan that, so far, have been unsuccessful in meeting statutory goals.

The MMPA defines conservation targets that scale directly with abundance, so stock size is an important driver of the likelihood that a plan will meet those targets. Three of the four lowest-ranking stocks had abundance estimates of less than 1,000 individuals, resulting in very low PBRs ( $< 10$ ). The PBR for right whales is often less than one individual per year (Table 1). Even under ideal circumstances, reducing bycatch to ZMRG becomes practically impossible for such stocks.

### **1.4.2 Unclassified Stocks**

This analysis identified some stocks in need of a plan, particularly Western U.S. Steller sea lions and Central North Pacific humpback whales. Both stocks interact with multiple Category I or II fisheries. Other stocks had very high abundance estimates and consequently high PBR estimates, and bycatch of these stocks was below PBR by hundreds to thousands of animals. This simple ranking method provides managers with an objective, quantitative tool for prioritizing marine mammal stocks requiring management action.

### **1.4.3 Caveats**

This method provides an objective means of evaluating the efficacy of Take Reduction Plans, but data limitations presented significant challenges to this approach. The data contained in U.S. marine mammal stock assessments vary in amount, precision, and age (GAO, 2008; Geijer and Read, 2013; Lewison et al., 2004; Read et al., 2006). Abundance estimates older than eight years are considered unusable because stocks size may have changed considerably over such a period. In those cases, PBR is undefined (Moore and Merrick, 2011). This prevented me from ranking the two Gulf of Mexico bottlenose dolphin stocks. Bycatch estimates are extrapolated from observer programs, when such data are available, but are negatively biased when derived from logbook and stranding data (Geijer and Read, 2013; Lewison et al., 2004; National Marine Fisheries Service, 2011; Read et al., 2006). Observer and stock assessment survey programs are

costly and their implementation varies greatly among stocks. Only half of U.S. fisheries are observed, which limits estimation of bycatch levels and their associated uncertainty (GAO, 2008; National Marine Fisheries Service, 2011). Defining stock structure also can be challenging, making estimates of abundance, PBR, and bycatch imprecise or biased (Geijer and Read, 2013; Read et al., 2006). Uncertainty regarding stock boundaries can lead to multiple reconfigurations of stock structure over time, as evidenced by bottlenose dolphins in the Atlantic and Gulf of Mexico. Finally, this evaluation was limited by the number of years of data available following implementation of a plan. I was unable to evaluate the False Killer Whale plan altogether.

## ***1.5 Conclusions***

Using a negotiated rulemaking process mandated by the MMPA as a case study, I assessed the ecological effectiveness of this multi-stakeholder approach. This evaluation was facilitated by statutory goals that provided measurable benchmarks. The expense and popularity of multi-stakeholder, consensus-based environmental management needs to be weighed relative to their ability to meet these ecological goals. Results from this case study suggest that, prior to implementation, managers should consider and plan for the challenges associated with such evaluations.

Regarding this case study, Take Reduction Plans generally have had an uneven record of meeting their statutory requirements. Successful plans were drafted by small



teams and produced regulations that were readily monitored and enforced, which facilitated compliance. Unsuccessful plans were produced by large, unwieldy teams in the northeastern U.S. that often addressed bycatch of small stocks and crafted regulations that were difficult to enforce or were not enforced. A comprehensive evaluation of the elements contributing to the success or failure of Take Reduction Plans will require investigation of the negotiation process, outputs, socio-political outcomes, and explorations of participant attitudes. A comparison of these social factors with the ecological outcomes presented here is critical to creating a comprehensive evaluation of this process and for suggesting improvements to this negotiated rulemaking process. Very limited evaluation of such consensus-based rulemaking processes has been conducted to date and more research is needed to explore whether the factors associated with ecological effectiveness of this participatory, environmental management process hold in other cases both within and outside the U.S.

## **2. Chapter 2: Social Evaluation of Marine Mammal Take Reduction Teams**

### ***2.1 Introduction***

#### **2.1.1 Public Participatory Processes**

More than 30 years ago, Phillip Harter (1982) formally introduced the idea of incorporating a more intensive citizen input into federal rulemaking processes by employing consensus-based, multi-stakeholder negotiation. Although the (traditionally input limited) 'decide, announce, defend' approach to rulemaking is still quite common, the Harter approach has certain advantages. Specifically, to address especially contentious or intractable problems, involving the affected parties in creating rules can decrease hostility among people with opposing viewpoints and improve the quality and legitimacy of agency decisions (Balint et al., 2011; Conley and Moote, 2003; Dukes, 2005; Gunton et al., 2003; Harter, 1982; Holmes and Scoones, 2000; Innes and Booher, 1999; Nie, 2003; Susskind and McMahon, 1985). This approach can foster buy-in and facilitate implementation of negotiated outputs, increase trust in institutions, and build social capital among the participants (Birkhoff and Lowry, 2003; Dietz and Stern, 2008; Holmes and Scoones, 2000; Innes and Booher, 2004).

Participatory processes have been described by a variety of applied and theoretical frameworks and disciplines including game theory (Luce and Raiffa, 1957; Schelling, 1978, 1980); the Institutional Analysis and Development (IAD) framework

(Ostrom, 1990, 1998, 2011); the Advocacy Coalition Framework (ACF) (Sabatier, 1988, 2007; Weible et al., 2009); applied dispute resolution and negotiation (Fisher and Ury, 2011; Susskind and Cruikshank, 1987, 2006); collaborative natural resource and environmental management (Beierle and Cayford, 2002; Gunton et al., 2003; Holmes and Scoones, 2000; Innes and Booher, 2004; Renn, 2006); and law (Coglianese, 1997, 2003; Funk, 1997; Harter, 2000; Susskind and McMahon, 1985). These frameworks share the following concepts: 1) behavior and knowledge of actors range from rational to boundedly rational; 2) who participates affects the likelihood of achieving agreement as well as compliance with outputs; 3) focusing on empirical issues and shared learning increases the likelihood of agreement and improves relationships and social capital; 4) repeated interactions among participants increase cooperation; 5) the use of a neutral, third party improves fairness; and 6) consensus agreements increase buy-in and decrease the likelihood of defection. Ideally, these ingredients will decrease hostility and increase trust, and incorporate multiple viewpoints into lasting agreements that are supported by the affected parties, who are committed to the process.

#### **2.1.1.1 Rational or boundedly rational actors**

Game theory models negotiations as interactions among rational actors. A rational actor has perfect knowledge, always behaves in a way that maximizes his own utility, and assumes that all other individuals will do the same (Hardin, 1982; Luce and

Raiffa, 1957; Schelling, 1980; Taylor, 1987). He calculates a pay-off structure based on past interactions with others and this pay-off structure will dictate his strategy for future interactions. Maximizing one's own utility, however, can result in an irrational outcome like the Tragedy of the Commons (Hardin, 1968).

The ACF draws from the social-psychology literature to characterize participants as boundedly rational. People pursue their interests and policy goals, but have limited cognitive abilities, which preclude individuals from having perfect knowledge, and they filter information through their perceptions and values (Allison and Zelikow, 1999; Jenkins-Smith and Sabatier, 1994; Leach and Sabatier, 1999; Sabatier, 1988, 1999; Sabatier and Jenkins-Smith, 1999; Weible et al., 2009). In comparison to rational actors who seek out information that supports their core beliefs and policy goals, boundedly rational actors may disregard information that runs counter to their beliefs and goals (Sabatier, 1988, 1999; Sabatier and Jenkins-Smith, 1999; Weible et al., 2009). People may remember losses more than gains and because their worldview is colored by their core beliefs and stakeholders from opposing viewpoints may interpret the same information in opposite ways to buttress their positions (Sabatier, 1988, 1999; Sabatier and Jenkins-Smith, 1999; Weible et al., 2009). As a result, actors are susceptible to "mutual devil shift" in which individuals believe their opponents are more malevolent and more powerful than they truly are (Sabatier, 1988, 1999; Sabatier and Jenkins-Smith, 1999; Weible et al., 2009). This

“devil shift” can lead people with the same core beliefs to form alliances to further their policy goals (Sabatier, 1988, 1999; Sabatier and Jenkins-Smith, 1999; Weible et al., 2009).

#### **2.1.1.2 Who participates**

Ideally, participatory processes bring together a variety of stakeholders with a wide range of experiences that will incorporate citizen values and help generate more realistic policies (Beierle and Cayford, 2002; Holmes and Scoones, 2000; Renn, 2006). Limited agency resources coupled with time constraints of stakeholders and the practicality of implementation, however, restrict who sits at the table. More intensive participatory processes may exclude members of the general public, many of whom will be directly affected by the policies created during stakeholder negotiations (Beierle and Cayford, 2002; Birkhoff and Lowry, 2003; Coglianesi, 2003; Gunton et al., 2003). For practical reasons, the agency may choose interest group representatives who can then relay information to their respective constituencies. As pointed out by Holmes and Scoones (2000), agencies may invite representatives with whom they already have an established relationship, which could limit the breadth of representation and thus inhibit the ‘ideal’ deliberative process. Nonetheless, agencies must balance the number of participants with the practicality of generating consensus-based decisions (Holmes and Scoones, 2000).

### **2.1.1.3 Shared learning**

One of the biggest challenges related to participatory processes pertains to the control over and reliability of information (Innes and Booher, 2004). Discrepancies among regulatory science (generated by the agency), research science (generated by the academic community), and lay knowledge (generated outside of the government or academic paradigms) can generate conflict (Gray et al., 2012; Jasanoff, 1990, 1995; Kinsella, 2002). Information concerns can be addressed through knowledge sharing or shared learning of both technical information and citizen knowledge. Shared learning occurs when participants collectively learn about relevant issues, exchange data, question existing information, and identify agreed-upon facts and data needs. Shared learning and a better understanding of the issues (technical and non-technical) facilitate creative problem-solving, improve decisions, and ultimately improve environmental outcomes (Beierle, 2002; Dietz and Stern, 2008; Innes and Booher, 2004). Shared learning also helps participants search for common values, which can decrease conflict while building trust and social capital among team members, as well as between participants and government institutions (Gray et al., 2012; Innes and Booher, 2004). Increased stakeholder trust in natural resource institutions improves the ability of those institutions to resolve conflicts and environmental problems (Beierle and Cayford, 2002; Dietz and Stern, 2008). Thus through shared learning, participatory processes can end stalemates and decrease hostility; increase knowledge and understanding of

environmental issues and opposing viewpoints; generate creative, new options; produce fair outcomes; and create beneficial second-order effects such as new partnerships and new institutions (Beierle, 2002; Beierle and Cayford, 2002; Birkhoff and Lowry, 2003; Dukes, 2005; Innes and Booher, 2004; Renn, 2006; Webler et al., 2001).

#### **2.1.1.4 Repeated interactions**

The likelihood of trust and cooperation usually increases with the number of interactions among stakeholders (Gray et al., 2012). Reciprocity can bring about cooperation, and a person's reputation over previous interactions will influence the behavioral expectations of others (Axelrod, 1984). The shadow of the future plays an important role in a rational decision to cooperate. If the number of interactions is infinite, maintaining a good relationship among participants into the future may be important enough to induce mutual cooperation (Axelrod, 1984). Other important factors that elicit mutual cooperation include communication and trust, enforcement of binding agreements, and changing the payoff structure (Ostrom, 1990).

#### **2.1.1.5 Facilitated negotiations**

To maintain fairness, most frameworks advocate using a neutral, third party to facilitate negotiations (Beierle and Cayford, 2002; Harter, 1982; Holmes and Scoones, 2000; Sabatier, 1988; Susskind and McMahon, 1985; Weible et al., 2009). Facilitators are content neutral and process advocates, meaning they do not favor one position over

another, and advocate for “fair, inclusive, and open processes that would balance participation and improve productivity while establishing a safe psychological space in which all group members could fully participate” (Doyle, 2007). In addition to ensuring the process is transparent and open, they are tasked with enforcing ground rules, providing support for shared learning, summarizing points of agreement, and moving the negotiation forward to help participants achieve consensus (Leach and Sabatier, 1999). Many consider facilitators a ‘key resource’ in managing participatory processes (Holmes and Scoones, 2000; Susskind and McMahon, 1985).

#### **2.1.1.6 Consensus-based negotiation**

Several of the frameworks advocate for using consensus-based decision-making (Beierle and Konisky, 2000; Harter, 1982; Holmes and Scoones, 2000; Sabatier and Weible, 2007). Requiring consensus increases the durability of the decision by incorporating the knowledge and values of multiple interests, and therefore, the likelihood of stakeholder buy-in and compliance with the output (Gunton et al., 2003; Innes and Booher, 1999). A consensus requirement also can increase the quality of deliberative processes by increasing fairness and facilitating communication among stakeholders (Beierle, 2002; Innes and Booher, 1999). Despite the benefits of consensus-based decision making, some have criticized it, pointing out that it can create a less than optimal solution that reflects the lowest common denominator or “group think;”



disempower a national or local majority in favor of local consensus; satisfy the regulated participants over ensuring the greater public good; and cause agency officials to allocate less time and fewer resources to other important issues while focusing consensus-based processes (Birkhoff and Lowry, 2003; Coglianese, 2003; Gunton et al., 2003). Moreover, unanimous consensus requires agreement by all. If one person believes his best alternative is to go outside the process, that individual has the ability to block agreement.

Despite these criticisms, consensus-based processes can create second- and third-order benefits, even if consensus is not achieved, such as external collaborations, generation of innovative ideas and social capital, increased trust and communication, and decreased animosity (Gunton et al., 2003; Innes and Booher, 1999). Several environmental agencies employ consensus-based, multi-stakeholder negotiations to address complex environmental problems with the goal of combining scientific expertise, practical knowledge, and public values (Conley and Moote, 2003; Leach et al., 2002; Niles and Lubell, 2012; Renn, 2006). One such agency is the National Marine Fisheries Service, which has used consensus-based, multi-stakeholder processes to mitigate harmful interactions between marine mammals and fishing gear.

### **2.1.2 Marine Mammal Bycatch and Multi-Stakeholder Negotiations**

The unintentional capture or entanglement of marine life in fishing gear (bycatch) kills thousands of marine mammals in U.S. waters annually (National Marine Fisheries Service, 2011; Read et al., 2006). The National Marine Fisheries Service (NMFS), the federal agency charged with protecting marine mammals in the U.S., creates and implements regulations subject to the Marine Mammal Protection Act of 1972 (MMPA, 16 U.S.C. 1361 *et seq.*). NMFS quantitatively evaluates fisheries impacts on marine mammals and identifies marine mammal populations that are vulnerable to fisheries bycatch. When bycatch exceeds statutory thresholds, NMFS convenes a team of stakeholders (Take Reduction Team) to develop consensus-based regulations to minimize marine mammal-fisheries interactions. Since 1996, NMFS has convened nine Take Reduction Teams (Table 5). Two teams were combined into one – the Gulf of Maine Harbor porpoise and Mid-Atlantic teams are now the Harbor Porpoise team - and one team (Atlantic Offshore Cetaceans) was disbanded because two of the three fisheries it addressed were closed. Team membership includes representatives from the fishing industry (fishermen, lobbyists, and leaders of fishing industry associations), environmentalists, scientific researchers, members of Regional Fisheries Management Councils and Commissions, and state and federal environmental managers. The proportions of stakeholder groups vary by team, but for all teams combined, fishermen are the largest stakeholder group with 37% of the total membership

(<http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm>). The False Killer Whale and Pacific Offshore Cetaceans teams are the only ones in which fishermen do not have the greatest proportion of the membership. Overall, representatives of Regional Fisheries Management Councils and commissions have the fewest members with only 5% of the total membership. Conservationists have the second-lowest average representation (10%).

**Table 5: List of Marine Mammal Take Reduction Teams and year first convened.**

<b>Take Reduction Team</b>	<b>Year Initiated</b>
<b>Atlantic Large Whale (ALW)</b>	1996
<b>Atlantic Offshore Cetaceans (AOC) <sup>a</sup></b>	1996
<b>Atlantic Trawl Gear (ATG)</b>	2006
<b>Bottlenose Dolphin (BD)</b>	2001
<b>False Killer Whale (FKW)</b>	2010
<b>Gulf of Maine Harbor Porpoise (HP) <sup>b</sup></b>	1996
<b>Mid-Atlantic (HP) <sup>b</sup></b>	1996
<b>Pelagic Longline (PL)</b>	2005
<b>Pacific Offshore Cetaceans (POC)</b>	1996

<sup>a</sup> Disbanded in 2001

<sup>b</sup> Merged to form the Harbor Porpoise team

The MMPA requires each Take Reduction Team to generate a consensus-based Take Reduction Plan within six months of the team's formation (16 U.S.C. 1387(f)(7)(A)(ii)). These plans contain agreed-upon actions to decrease marine mammal bycatch. Consequently, teams meet four or five times within those first six months. Thereafter, teams meet annually, or when data show increases in bycatch that exceed statutory requirements. The plans are "living documents," continually modified and amended based on newly available information, mitigation study results, and changes in fisheries management practices. Although NMFS is obligated to use the consensus agreement, if no such agreement exists, the agency must generate its own regulations that may not include the best interest of all parties involved, but rather regulations that meet statutory mandates (16 U.S.C. 1387(f)(7)(A)(ii)). This shadow of regulation can act as an incentive for stakeholders to reach consensus. In addition, despite the initial, tight six-month deadline, the shadow of the future is long, greater than ten years for most teams, and the negotiations are professionally facilitated, which encourages communication among team members.

## **2.1.3 Early Implementation of Take Reduction Planning**

### **2.1.3.1 Time constraints**

The MMPA requires the Take Reduction Team to submit a draft plan to NMFS within six months (16 U.S.C. 1387(f)(7)(A)(i)), and that NMFS publish the proposed plan in the Federal Register within 60 days after receipt of the draft plan (16 U.S.C.

1387(f)(B)(i)). The agency then must publish the final plan and implementation rules within 13 months after the team was first established (16 U.S.C. 1387(f)(7)(C)). NMFS missed the deadline for publishing the proposed plans for five teams evaluated by the Government Accountability Office (GAO, 2008), and missed the deadline for publishing the final plans for four of the five teams. Agency officials attributed these failures to the time needed to complete rulemaking and respond to public comments (GAO, 2008). Missing these deadlines, however, created mistrust and frustration among team members, decreased the credibility of the agency, and undermined the negotiation process (RESOLVE, 1999; Young, 2001). For two particular stocks (Gulf of Maine and mid-Atlantic harbor porpoise), the environmental stakeholders felt the impacts of the rule-making delays were so dire they filed suit to compel NMFS to adopt the plans (Young 2001). This defection of the environmental groups engendered mistrust among other stakeholders, who suspected that the settlement agreement contained additional language that was not agreed upon by the team (Young, 2001). Young (2001) described the agency's failure to implement the Take Reduction Plans within the required timeframes as "the greatest downfall in the process" (p. 345). Sixty percent of surveyed Take Reduction Team members were dissatisfied with the outcome, largely because of time constraints and lack of follow-through by NMFS (Coglianese, 2003; RESOLVE, 1999; Young, 2001). Many believed that time constraints hampered their ability to achieve consensus.

### **2.1.3.2 Coordination with other mandates and statutes**

While learning how to implement the take reduction planning requirements of the MMPA, the agency made organizational errors reflective of Graham Allison's second model of government behavior - there was a noticeable lack of coordination with other agency divisions (Allison and Zelikow, 1999). Other offices within NMFS are responsible for implementing fisheries management policies, most notably those prescribed by the Magnuson-Stevens Fisheries Management and Conservation Act of 1976 (16 U.S.C. 1801 *et seq.*). To achieve the management and conservation goals of the statute, eight Regional Fisheries Management Councils create Fisheries Management Plans to regulate fish stocks within their jurisdictions. Each plan must be approved and implemented by NMFS. Although some members of these Fishery Management Councils also serve as Take Reduction Team members, in the late 1990s there was a noticeable lack of coordination between the Take Reduction Teams and Fisheries Management Councils, as well as between the Office of Protected Resources (the office in NMFS that implements MMPA regulations) and the NMFS offices working on fishery management regulations in the areas overlapping with some of the marine mammal take reduction regulations (Young, 2001). These overlaps involved the Atlantic Offshore Cetaceans, Gulf of Maine Harbor Porpoise, and Mid-Atlantic Take Reduction Teams. According to Young (2001), these fishery management regulations overtook the Take Reduction Plans, requiring the teams to modify portions of their plans. NMFS also changed parts of all of

the plans without consulting the teams for consensus. The lack of coordination within the agency (as predicted by Allison) sabotaged the conservation and consensus efforts of these teams (Young, 2001).

In addition to the Magnuson-Stevens Fisheries Management and Conservation Act, Take Reduction Plans are subject to Section 7 of the Endangered Species Act of 1973 (ESA, 16 U.S.C. 1531 *et seq.*) to ensure they do not jeopardize the continued existence of ESA-listed species; analysis under the National Environmental Policy Act of 1970 (42 U.S.C. 4321 *et seq.*) to evaluate the environmental impacts of the actions resulting in a possible environmental assessment or environmental impact statement; and economic impact analyses under the Regulatory Flexibility Act of 1980 (5 U.S.C. §601 *et seq.*). Other statutes to which the Take Reduction Plans must conform include the Coastal Zone Management Act of 1972 (16 U.S.C. §1461 *et seq.*), the Information Quality Act of 2000 (44 U.S.C. §3516), and the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 *et seq.*).

#### **2.1.3.3. Data deficiencies**

Data deficiencies also were problematic in creating effective Take Reduction Plans and participant buy-in. According to the Government Accountability Office (GAO, 2008), the NMFS marine mammal stock assessment data from which bycatch information and statutory thresholds are derived, are “incomplete, outdated, or imprecise” (p.10). Suspicions about the credibility of the data hampered several

negotiations (RESOLVE, 1999; Young, 2001). According to RESOLVE (1999), nearly 70% of the team members surveyed felt the data were insufficient.

#### **2.1.3.4 Early lack of consensus**

Two teams failed to achieve full consensus, the Atlantic Large Whale and the Mid-Atlantic teams. At the time, the Atlantic Large Whale Team had 32 members (RESOLVE, 1999). It has since grown to more than 80 members and alternates combined. In 1997, NMFS seemed to overlook many of the consensus items from the original negotiations and modified the proposed plan (Young, 2001). First the agency added restrictions, which generated over 13,000 public comments opposing the rule. In response, the agency swung the other way and substantially weakened the proposed plan (Young, 2001). These changes polarized the team and created mistrust and animosity (Young, 2001).

The Mid-Atlantic Team was one of the teams involved in a lawsuit filed by environmental organizations to compel NMFS to meet the statutory deadlines (Young, 2001). This team failed to achieve consensus on only one issue regarding funding of a scientifically valid acoustic deterrence device experiment. It has since merged with the Gulf of Maine Harbor Porpoise Team to form the Harbor Porpoise Take Reduction Team.



After investing nearly 20 years in marine mammal Take Reduction planning and in light of the early challenges described above, some key questions have emerged. Has the NMFS addressed these challenges? Do these teams have the necessary ingredients to create efficient and effective Take Reduction Plans? Do the members believe the negotiations are fair? Have these teams achieved consensus and if not, why not? How satisfied with the plans are the members? Do the members believe that they are mitigating bycatch? Do these plans actually reduce marine mammal bycatch? What factors affect actual and perceived plan effectiveness?

#### **2.1.4 Evaluation of Marine Mammal Take Reduction Teams**

There are currently seven active Take Reduction Teams (Table 5). A 2008 review of the marine mammal take reduction planning process by the Government Accountability Office explicitly identified the need for “a comprehensive strategy for assessing the effectiveness of Take Reduction Plans and ... regulations that have been implemented” (GAO, 2008, p. 37). In addition, Gunton et al. (2003) called for investigations of the “key attributes” of consensus-based, environmental decision-making and the need to identify the prerequisites for success.

This research aims to address the research questions described above through the following inquiries: 1) evaluate Take Reduction Team participant opinions of the take reduction negotiation process, outputs, and outcomes with respect to the above-

mentioned ingredients required for successful multi-stakeholder, consensus-based negotiation (participants, shared learning, repeated interactions, facilitated meetings, and consensus-based outputs); 2) compare opinions across teams and stakeholder groups; and 3) identify and explore the reasons for similarities and differences among respondents, teams, and stakeholder groups.

## **2.2 Methods**

### **2.2.1 Quantitative Data Collection- Survey Sample**

Social capital, or the benefits of creating social networks through repeated interactions among individuals, embodies trust, reciprocity, and cooperation. Social capital combined with fairness integrate the ingredients of shared learning, balanced team membership, repeated interactions, facilitated meetings, and consensus-based decision making. Thus, using social capital and fairness to represent these ingredients required for successful consensus-based, multi-stakeholder negotiation, I drafted survey questions to evaluate Take Reduction Team participants' perceptions of the negotiation process. I also included questions to evaluate stakeholders' satisfaction with outputs (Take Reduction Plans) and outcomes. To inform the development of the survey instrument, I conducted two focus groups consisting of 5-10 members that included fishermen, environmentalists, university and government marine mammal scientists, and Federal marine mammal managers. Participants received draft survey questions

and provided feedback regarding their clarity and content via a facilitated discussion. Survey questions included topics about the Take Reduction Team negotiation process, outputs, and outcomes. Participants were provided dinner as compensation.

Current and former Take Reduction Team participants including facilitators and agency staff (n=219) received an email with a weblink to a survey (Qualtrics Labs Inc., Provo, UT) containing 15 questions using a 5- or 7-point Likert scale about marine mammal Take Reduction Teams. To increase response rates, I supplemented the web survey with a conventional mail survey (n=25), an incentive (i.e., chance to win one of two gift cards), and postcards sent via conventional mail notifying each respondent of the upcoming survey. Web survey participants who had not taken the survey received an email reminder every two weeks for eight weeks, while conventional mail respondents received a postcard reminder at three weeks and a second survey at six weeks. Survey data were exported into Microsoft Excel and coded for ease of analysis.

### **2.2.2 Qualitative Data Collection**

Semi-structured interviews of 22 individuals representing each stakeholder group (Table 6) supplemented the survey by providing qualitative information about stakeholders' experiences, perceptions, feelings, and insights about marine mammal take reduction planning. Face-to-face interviews were recorded using an Olympus WS-700M digital audio recording device, while phone interviews were conducted using

Skype and recorded using Quick Time Player version 10.3 (Apple, Inc.). I then transcribed (verbatim) all interviews into a Microsoft Word document. An interview guide prompted respondents to describe their feelings and opinions about the Take Reduction Team negotiation process, outputs (Take Reduction Plans), implementation, and outcomes. I imported interview transcripts and open-ended survey comments into NVivo, v. 10 to detect emergent themes, search for commonalities, and identify differences among the stakeholders and teams. To facilitate searches for commonalities and differences, I arranged the interview guide similarly to the survey, which helped to organize interview responses into broad topics. I extracted key points from the qualitative data generated deductively by the interview guide and communicated inductively by the interviewees, and grouped similar points into categories. For example, respondents' views about law enforcement were grouped together, as were their thoughts about compliance. I then nested these concepts into a broader theme of implementation of the Take Reduction Plans. This study received approval from Duke University's Institutional Review Board (IRB) for Non-Medical Research on Human Subjects as exempt research.

**Table 6: Interview subjects classified by stakeholder affiliation and Take Reduction Team. ALW=Atlantic Large Whale, AOC=Atlantic Offshore Cetaceans, ATG=Atlantic Trawl Gear, BD=Bottlenose Dolphin, FKW=False Killer Whale, HP=Harbor Porpoise, PL=Pelagic Longline, and POC=Pacific Offshore Cetaceans.**

<b>Affiliation</b>	<b>ALW</b>	<b>AOC</b>	<b>ATG</b>	<b>BD</b>	<b>FKW</b>	<b>HP</b>	<b>PL</b>	<b>POC</b>	<b>Total</b>
<b>Environmentalists</b>	3	2	1	2	1	3	2	1	3
<b>Facilitators</b>	2	1	1	1	1	1	1	1	3
<b>Federal employees</b>	3	3	2	3	2	3	3	2	3
<b>Fishing Industry</b>	2	0	1	2	1	2	1	1	6
<b>Fisheries managers</b>	1	0	1	1	0	1	1	1	2
<b>Researchers</b>	1	1	1	2	2	1	1	1	3
<b>State managers</b>	2	0	1	1	0	2	1	0	2
<b>Total</b>	<b>14</b>	<b>7</b>	<b>8</b>	<b>12</b>	<b>7</b>	<b>13</b>	<b>10</b>	<b>7</b>	<b>22</b>
<b>Missing</b>	0	3	0	0	2	0	0	1	6

### 2.2.3 Survey Analyses

The original survey database contained 139 records (from 139 respondents).

Several respondents were members of more than one Take Reduction Team, however. I separated the records of respondents who answered questions about more than one team so that each database record contained responses for only one team. This increased the database to 268 records/total responses and created a one-to-many relationship in

which each database record corresponded to an individual's responses about only one team (one respondent to many teams/records/responses, Table 7).

**Table 7: Survey responses by stakeholder affiliation, including the number and proportion of individuals who are members of more than one team and total number of responses per stakeholder group.**

	Researchers	Fishing Industry	Environmentalists	State	Federal	Fisheries managers	Facilitators	Total
# individuals	30	41	8	21	30	4	5	139
# individuals on >1 team	10	14	6	11	17	2	1	61
% individuals on >1 team	33%	34%	75%	52%	57%	50%	20%	44%
Total # responses (records in database)	51	62	24	37	75	10	9	268

Although individuals could identify themselves as belonging to more than one stakeholder group, multiple stakeholder groups and multiple teams per respondent would have confounded the analyses. In addition, only 15 stakeholders identified with more than one stakeholder group so I employed the following decision rules to classify individuals into one stakeholder category: 1) used clarifying comments in the open-ended section of the survey to categorize those individuals into one group; 2) classified individuals who identified themselves with a known category and "other," in the known group; and 3) used the affiliations identified in the most recent NMFS Take

Reduction Team membership rosters. I, therefore, created a one-to-one relationship between respondent and stakeholder affiliation. There was, then, a one-to-many relationship between an individual's stakeholder affiliation and Take Reduction Team/database records, but for every team, there was only one response or record per individual. Therefore, from this point forward when describing the data by stakeholder affiliation (e.g. fishermen, researcher, etc.), I will discuss the results in terms of the proportion of total RESPONSES to each question (N= 268). On the other hand, because there is only one record per Take Reduction Team (N=268, Table 8), when discussing the data grouped by team, the number of RESPONSES per team (N=268) is the same as the number of RESPONDENTS per team (N=268, Table 8).

**Table 8: Number of survey responses by Take Reduction Team, includes responses by individuals on more than one team. ALW= Atlantic Large Whale, AOC=Atlantic Offshore Cetaceans, ATG=Atlantic Trawl Gear, BD=Bottlenose Dolphin, FKW=False Killer Whale, HP=Harbor Porpoise, PL=Pelagic Longline, POC=Pacific Offshore Cetaceans**

	ALW	AOC	ATG	BD	FKW	HP	PL	POC	TOTAL
<b>Total # individuals = responses = records in database</b>	65	14	23	53	19	54	29	11	<b>268</b>
<b># individuals on &gt; 1 team</b>	43	11	20	37	7	48	21	4	
<b>% individuals on &gt;1 team</b>	66%	79%	87%	70%	37%	89%	72%	36%	

Responses of “I don’t know” and “N/A” were removed from the database for analyses. I generated frequency distributions for each survey question grouped by stakeholder affiliation and Take Reduction Team.

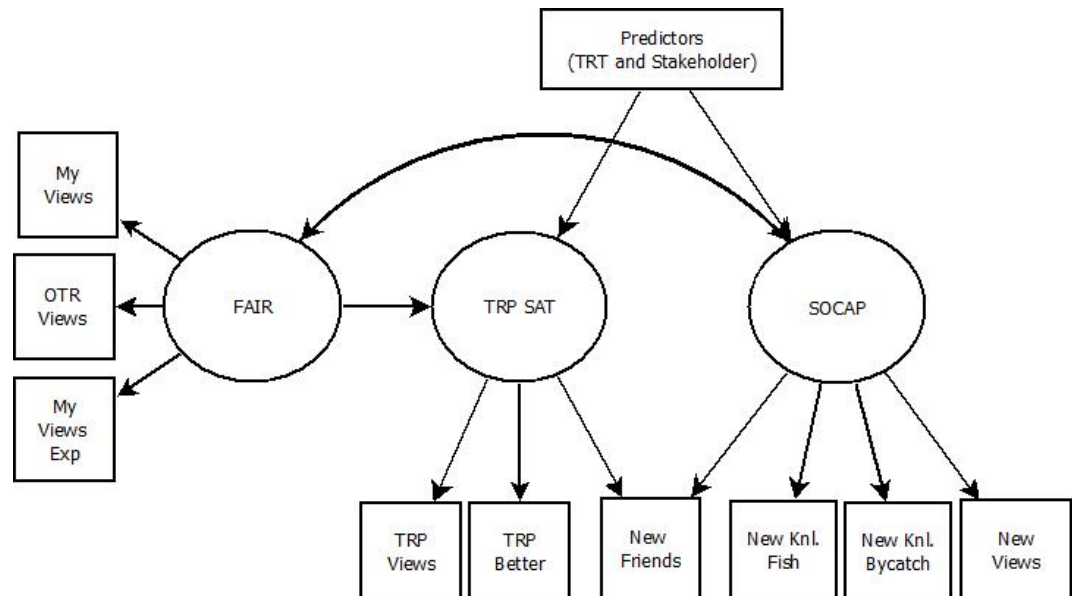
I employed Structural Equation Models (SEMs) with latent variables to analyze the survey data using MPlus, v 6.1 (Muthén and Muthén, 1998-2010). As described above, the survey was designed to capture participants’ feelings about social capital, fairness, and satisfaction with team outputs and outcomes. Prior to SEM creation, I conducted an Exploratory Factor Analysis employing Geomin rotation (Mplus, v 6.1) to help identify potential latent variables. Factor loadings of the accepted model ranged from 0.532-1.057. Although the model fit was best with five factors, it placed one variable (NEWFRIENDS) in a factor by itself (Table 9), which was not theoretically relevant, so I chose to use the following four latent variables based on the results of the factor analysis: shared learning and social capital (SOCAP), fairness (FAIR), satisfaction with the Take Reduction Plan (TRP SAT), and perceived ecological success (PCD ECO, Table 10). The software would not run the factor analysis when I tried to include a variable about the effect of Take Reduction Plans on the livelihoods of fishermen, so those results are discussed separately, outside of the model.



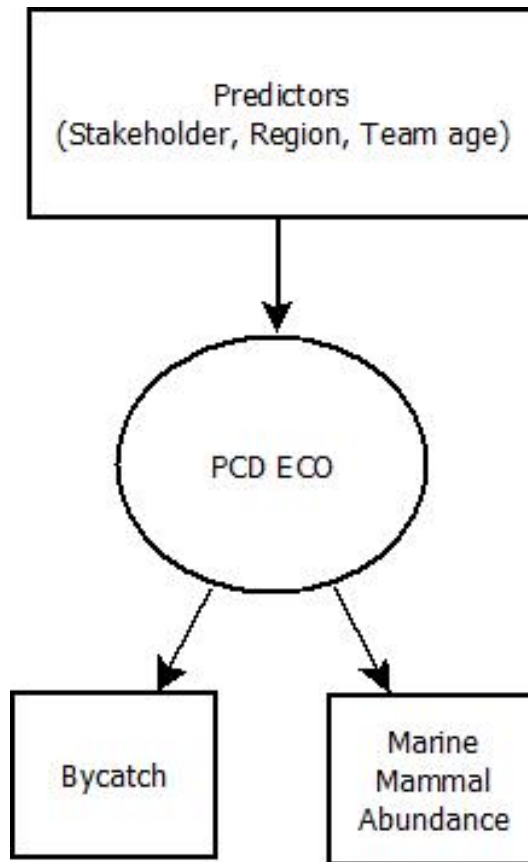
**Table 9. Factor loadings with five factors. It depicted NEWFRIENDS in a factor by itself.**

Survey Question (Measurement Indicator)	Factor 1	Factor 2 (SOCAP)	Factor 3 (FAIR)	Factor 4 (PCD ECO)	Factor 5 (TRP SAT)
NEWVIEWS	0.261	<b>0.814</b>	0.567	0.142	0.304
NWKNLFSH	0.215	<b>0.898</b>	0.414	0.161	0.386
NEWKNLBC	0.255	<b>0.848</b>	0.464	0.142	0.421
NEWFRIENDS	<b>1.907</b>	0.514	0.435	0.333	0.347
MYVIEWS	0.191	0.484	<b>0.958</b>	0.193	0.511
MYVWSEXP	0.179	0.310	<b>0.820</b>	0.151	0.429
OTR VIEWS	0.224	0.467	<b>0.890</b>	0.075	0.443
TRP VIEWS	0.199	0.314	0.428	0.382	<b>0.739</b>
TRPBETTR	0.145	0.407	0.463	0.237	<b>0.872</b>
BC	0.180	0.196	0.253	<b>0.719</b>	0.505
ABUND	0.199	0.213	0.204	<b>1.177</b>	0.352

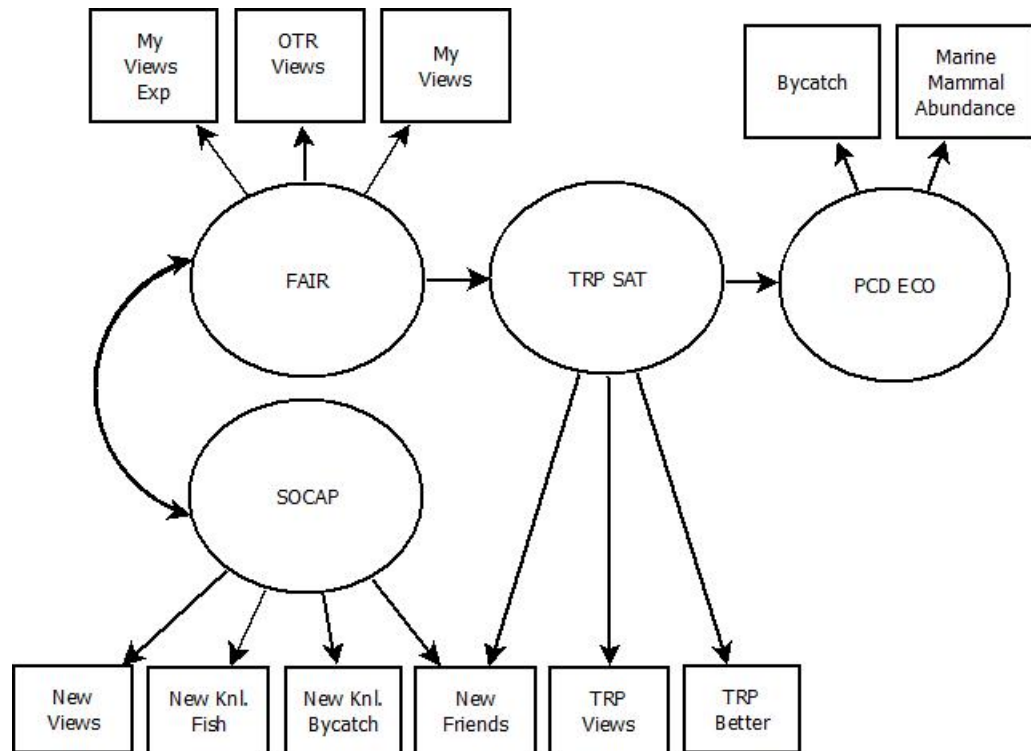
I created three models using the “CLUSTER” command to correct for non-independence of the observations (i.e., multiple Take Reduction Teams per respondent). All models used a Mean- and Variance-adjusted Weighted Least Square (WLSMV) estimator, the Mplus default for complex models with categorical variables (Muthén and Muthén, 1998-2010). The first model characterized respondents’ opinions about the negotiation process and their satisfaction with the Take Reduction Plan (Figure 4). The second model illustrated stakeholder perceptions about the outcomes or success of the Take Reduction Plans (Figure 5), and the final model combined the first two to provide a generalized conceptualization of stakeholder perceptions of marine mammal Take Reduction planning (Figure 6). Appendix A provides a general overview of SEMs.



**Figure 4: Structural Equation Model (SEM) #1 of the marine mammal Take Reduction Team Negotiation Process. Circles depict latent variables and squares depict measurement indicators and independent predictors. For clarity, error terms were omitted.**



**Figure 5: Structural Equation Model (SEM) #2 of stakeholder perceived ecological outcomes of marine mammal Take Reduction Plans. Circles depict latent variables and squares depict both measurement indicators and independent predictors. For clarity, error terms were omitted.**



**Figure 6: Full conceptual Structural Equation Model (SEM) of the marine mammal Take Reduction negotiation process and perceived ecological outcomes. Circles depict latent variables and squares depict measurement indicators. Error terms were omitted for clarity.**

In this study, all three models were over-identified, allowing for testing of each model fit. To facilitate model identification, I scaled each latent variable to one measurement indicator, meaning that the factor loading of one measurement indicator for each latent variable was set to one. To test for the consistency or reliability of the survey questions (measurement indicators), I used the squared multiple correlation coefficient,  $r^2$  (Bollen, 1989) for each observed indicator, which explains the systematic variance in each indicator (see Appendix A for description of measurement models).

## **2.3 Results**

### **2.3.1 Survey Responses**

Nearly half of the respondents (61, 44%) were members of more than one Take Reduction Team (Tables 7 and 8). The fishing industry (fishermen, lobbyists, and leaders of fishing industry associations) had the largest number of individual respondents (41) with 62 total responses and 14 individuals who were members of more than one team (Table 7). Federal workers (employees of the Marine Mammal Commission and NMFS managers and scientists) had the second largest number of individual respondents (30), but the largest number of total responses (75), and 17 people participating on more than one team (Table 7). Members of Regional Fisheries Management Councils or commissions and facilitators made up the fewest respondents with four individuals (ten total responses) and five individuals (nine total responses) respectively (Table 7).

The combined response rate for the web and mail surveys was 59% (139 of 234). Response rates for the two modes differed substantially, however (web survey=60%, mail survey =36%). The Atlantic Large Whale team had the greatest number of respondents (65), while the Pacific Offshore Cetaceans team had only 11, which is consistent with the relative team sizes. Individuals were fairly experienced, with 66% of the responses indicating participation in four or more Take Reduction Team meetings or webinars.

## **2.3.2 Structural Equation Model**

### **2.3.2.1 Model 1: Negotiation process and satisfaction with the Take Reduction Plan**

<i>2.3.2.1.1 Latent Variable Model</i>
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This model contains three latent variables that represent the following concepts:

1) shared learning and social capital (SOCAP); 2) fairness of the negotiation process (FAIR); and 3) satisfaction with the Take Reduction Plan (TRP SAT). All three latent variables were regressed on covariate predictors that included the Take Reduction Team identity, team size and age, stakeholder affiliation, and U.S. geographic region. To improve model fit, I discarded insignificant covariates. None of the covariate predictors (team identity, age, or size, stakeholder affiliation, or region) significantly influenced the fairness latent variable (FAIR). In addition, I initially regressed satisfaction with the Take Reduction Plan (TRP SAT) on both shared learning/social capital (SOCAP) and fairness

(FAIR) theorizing that both aspects of the negotiation process should influence satisfaction with the output. However, the model with the best fit showed that only fairness significantly influenced satisfaction with the Take Reduction Plan, but there was a significant covariance between FAIR and SOCAP ( $\varphi = 0.5$ ,  $p=0.000$ ).

#### *2.3.2.1.2 Measurement model*

The latent variable SOCAP was measured by four survey questions about stakeholder learning and relationships using a 5-point Likert scale ranging from “strongly disagree” to “strongly agree” (Table 10). I designated NEWVIEWS as the scaling indicator, meaning that the factor loading for NEWVIEWS was set to one (Table 10). The other two latent variables used the same 5-point Likert scale. Fairness (FAIR) was measured by three questions. I assigned MYVIEWS as the scaling indicator for FAIR, while satisfaction with the Take Reduction Plan (TRP SAT) was measured by three questions with TRPVIEWS as the scaling indicator. In addition, satisfaction with the Take Reduction Plan (TRP SAT) shared the measurement indicator NEWFRIENDS with the latent variable shared learning/social capital (SOCAP) (Table 10, Figure 4).

**Table 10: Structural Equation Models, latent variables, measurement indicators, factor loadings ( $\lambda$ ), and reliabilities (squared multiple correlation coefficients). SOCAP=shared learning and social capital; FAIR=fairness; TRP SAT=satisfaction with the Take Reduction Plan; PCD ECO=perceived ecological success.**

Model	Latent Variable	Measurement Indicator	Factor Loadings ( $\lambda$ )	R-squared
<b>Model 1</b>	SOCAP	NEWVIEWS*	*1.00	0.75
		NEWKNLFISH	0.97	0.72
		NEWKNLBC	1.00	0.75
		NEWFRIENDS	0.52	0.34
	FAIR	MYVIEWS*	*1.00	0.93
		MYVIEWSEXP	0.83	0.64
		OTR VIEWS	0.92	0.80
	TRP SAT	TRPVIEWS*	*1.00	0.62
		TRPBETTER	1.05	0.67
		NEWFRIENDS	0.26	see above
<b>Model 2</b>	PCD ECO	BC*	*1.00	0.94
		ABUND	0.88	0.76
<b>Model 3</b>	SOCAP	NEWVIEWS*	*1.00	0.71
		NEWKNLFISH	1.00	0.72
		NEWKNLBC	1.03	0.75
		NEWFRIENDS	0.49	0.37
	FAIR	MYVIEWS*	*1.00	0.92
		MYVIEWSEXP	0.83	0.63
		OTR VIEWS	0.92	0.77
	TRP SAT	TRPVIEWS*	*1.00	0.68
		TRPBETTER	0.96	0.62
		NEWFRIENDS	0.38	see above
	PCD ECO	BC*	*1.00	0.98
		ABUND	0.87	0.73

\*scaling indicators



### 2.3.2.1.3 Reliability and Model Fit

Model fit was excellent (Table 11) as measured by chi-square difference test ( $p=0.1394$ ), Root Mean Square Error of Approximation (RMSEA=0.011), Comparative Fit Index (CFI =0.999), and Tucker-Lewis Index (TLI=0.999). Reliability (Table 10) ranged from 0.26 (NEWFRIENDS) to 1.00 (NEWKNLBC), and with the exception of NEWFRIENDS, reliabilities were good (0.62-.0.93). The independent predictors explained only 14% of the variance in the shared learning/social capital (SOCAP) latent variable, but explained nearly half of the variance (42%) in the latent variable representing satisfaction with the Take Reduction Plan (TRP SAT, Table 12).

**Table 11: Structural Equation Model fit indices for the three models.**

Test of Model Fit	Model 1: Negotiation process and satisfaction with Take Reduction Plans	Model 2: Perceived ecological success of Take Reduction Plans	Model 3: Full conceptual model of Take Reduction Team negotiation process, outputs, and outcomes
Chi-square difference test	2.184	0.001	1.001
Chi-square difference df	1	1	1
Chi-square difference p-value	0.139	0.977	0.317
RMSEA	0.011	0.000	0.044
CFI	0.999	1.000	0.990
TLI	0.999	1.009	0.987

**Table 12: Squared multiple correlation coefficients ( $r^2$ ) for the latent variables. SOCAP=shared learning and social capital; FAIR=fairness; TRP SAT=satisfaction with the Take Reduction Plan; PCD ECO=perceived ecological success.**

Model	Latent Variable	R-Squared
<b>Model 1</b>	SOCAP	0.14
	TRP SAT	0.42
<b>Model 2</b>	PCD ECO	0.24
<b>Model 3</b>	TRP SAT	0.37
	PCD ECO	0.30

#### **2.3.2.2 Model 2: Perceived ecological success**

##### *2.3.2.2.1 Latent Variable Model*

The best fitting model included one latent variable representing perceived ecological success (PCD ECO), which was regressed on the same independent predictors as the previous model. Again, I retained only those variables that were significant ( $p < 0.05$ , Figure 5).

##### *2.3.2.2.2 Measurement Model*

PCD ECO was measured by two 7-point Likert scale questions about effects of the Take Reduction Team process on marine mammal bycatch and marine mammal abundance (“made much worse” to “made much better,” see Appendix B). I chose BYCATCH as the scaling indicator.

#### 2.3.2.2.3 Reliability and Model Fit

Model fit was excellent as measured by the chi-square difference test, RMSEA, CFI, and TLI (Table 11). Reliabilities of the measurement indicators for the latent variable were 0.76 and 0.94 (Table 10). The independent predictors explained 24% of the variance in the latent variable perceived ecological success (PCD ECO, Table 12).

#### 2.3.2.3 Model 3: General conceptual model

##### 2.3.2.3.1 Latent Variable Model

This model combines the previous two and thus contains all four latent variables and their corresponding measurement indicators (Figure 6). It characterizes the relationships between participants' views of the negotiation process (social capital and fairness), their satisfaction with the Take Reduction Plans and their perceptions of how effective the plans are at reducing marine mammal bycatch and increasing marine mammal abundance. Perceived impacts of the Take Reduction Plans on marine mammal bycatch and abundance were influenced directly by satisfaction with the Take Reduction Plan (TRP SAT,  $\beta=0.66$ ,  $p=0.000$ ) and indirectly by perceived fairness of the negotiation (FAIR,  $\gamma=0.34$ ,  $p=0.000$ ). The covariance between SOCAP and FAIR also was significant ( $\varphi=0.50$ ,  $p=0.000$ ).

##### 2.3.2.3.2 Measurement Model

Once again, TRP SAT and SOCAP shared the measurement indicator NEWFRIENDS. The indicators for FAIR, SOCAP, and TRP SAT were measured by 5-

point Likert scale questions (from “strongly agree” to “strongly disagree,” see Appendix B) while the PCD ECO measurement indicators were derived from responses to questions with a 7-point Likert scale (from “made much worse” to “made much better,” see Appendix B). I retained the same scaling indicators that were used in the previous models (Table 10).

#### 2.3.2.3.3 *Reliability and Model Fit*

The chi-square difference test, RMSEA, CFI, and TLI revealed good model fit (Table 11). Reliability indicators ranged from 0.37 (NEWFRIENDS) to 0.98 (BYCATCH). The latent variable fairness (FAIR), explained 37% of the variance of satisfaction with the Take Reduction Plan (TRP SAT), while FAIR, and TRP SAT explained 30% of the variance of Perceived Ecological Success (PCD ECO, Table 11).

### **2.3.3 Social Capital and Shared Learning (SOCAP)**

Two factor loadings for the measurement indicators about shared learning (NEWKNLFISH, NEWKNLBC) were significant and similar in value to the scaling indicator (Table 10). This indicates that the direct effects of SOCAP on the observed indicators of shared learning and an improved understanding of the viewpoints of others were nearly equivalent, and at nearly a one-to-one relationship. This suggests that a one-unit increase in SOCAP would cause roughly a one unit increase in NEWKNLFISH, NEWKNLBC and NEWVIEWS. The other measurement indicator,

NEWFRIENDS, was significant, but its factor loading was substantially lower than the others. It also partially loaded on another latent variable (TRP SAT), meaning that improvements in participant views of social capital and shared learning would somewhat improve their views about creating new relationships, and that improvements in stakeholder satisfaction with the Take Reduction Plan also would mildly improve their perceptions about creating new relationships. There was a significant association (covariance) between SOCAP and the latent variable for fairness (FAIR,  $\varphi = 0.5$ ,  $p=0.000$ ).

Although the teams rated shared learning and social capital fairly highly (83% on average agreed or strongly agreed), the Bottlenose Dolphin and Atlantic Offshore Cetaceans teams had the most positive attitudes. Approximately 90% of their averaged responses to the four questions comprised in this latent variable were either “agree” or “strongly agree.” Conversely, teams with the lowest averages included False Killer Whale, Atlantic Large Whale, and Atlantic Trawl Gear, in which an average of 8% disagreed or strongly disagreed with the survey questions about social capital and shared learning.

More than 90% of the responses showed stakeholders had a greater understanding of the viewpoints of others during the negotiation (NEWVIEWS). Members of the Bottlenose Dolphin team and responses by the facilitators most strongly

agreed. Stakeholders with the least enthusiastic responses included members of the Atlantic Trawl Gear team and responses by scientific researchers (Table 13). The majority of responses (69%) indicated stakeholders agreed or strongly agreed they had established new or long-term relationships with members with opposing viewpoints (NEWFRIENDS). Members of the Harbor Porpoise team and responses by federal employees scored the highest, with approximately 80% agreeing or strongly agreeing. Once again, members of the Atlantic Trawl Gear team and responses by researchers had dimmest outlook with nearly one-third of disagreeing or strongly disagreeing (Table 14).

**Table 13: Responses to the question if stakeholders have a better understanding of the viewpoints of others, by Take Reduction Team (top) and stakeholder category (bottom).**

NEWVIEWS	ALW	ATG	BD	FKW	HP	POC	PL	AOC	Total
Strongly Disagree	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Disagree	3.2%	0.0%	0.0%	5.6%	0.0%	0.0%	3.6%	0.0%	1.6%
Neither	4.8%	18.2%	4.2%	5.6%	6.0%	9.1%	7.1%	0.0%	6.4%
Agree	46.0%	59.1%	33.3%	38.9%	36.0%	45.5%	32.1%	45.5%	40.6%
Strongly Agree	44.4%	22.7%	62.5%	50.0%	58.0%	45.5%	57.1%	54.5%	51.0%
	Researcher	Fishing Industry	Environmentalist	State	Federal	FMC	Facilitator		Total
Strongly Disagree	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Disagree	6.3%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%
Neither	14.6%	5.6%	4.3%	2.8%	4.2%	11.1%	0.0%	0.0%	6.4%
Agree	35.4%	61.1%	47.8%	41.7%	31.9%	22.2%	11.1%	0.0%	40.6%
Strongly Agree	43.8%	29.6%	47.8%	55.6%	63.9%	66.7%	88.9%	0.0%	51.0%

**Table 14: Responses to the question if stakeholders established new, long-term professional or personal relationships with team members who have differing viewpoints, by Take Reduction Team (top) and stakeholder group (bottom).**

NEWFRIENDS	ALW	ATG	BD	FKW	HP	POC	PL	AOC	Total
Strongly Disagree	0.0%	4.5%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.8%
Disagree	10.9%	22.7%	12.8%	11.1%	7.8%	0.0%	11.5%	11.1%	11.3%
Neither	17.2%	36.4%	17.0%	16.7%	11.8%	27.3%	19.2%	33.3%	19.0%
Agree	51.6%	31.8%	42.6%	50.0%	56.9%	54.5%	38.5%	33.3%	47.2%
Strongly Agree	20.3%	4.5%	27.7%	22.2%	21.6%	18.2%	30.8%	22.2%	21.8%
	Researcher	Fishing Industry	Environmental	State	Federal	FMC	Facilitator	Total	
Strongly Disagree	0.0%	1.9%	4.2%	0.0%	0.0%	0.0%	0.0%	0.8%	
Disagree	22.9%	13.2%	20.8%	5.6%	4.2%	0.0%	0.0%	11.3%	
Neither	22.9%	18.9%	12.5%	22.2%	15.5%	33.3%	14.3%	19.0%	
Agree	47.9%	47.2%	50.0%	50.0%	50.7%	22.2%	14.3%	47.2%	
Strongly Agree	6.3%	18.9%	12.5%	22.2%	29.6%	44.4%	71.4%	21.8%	

Learning about marine mammal bycatch and the fisheries that interact with marine mammals was rated quite high, with more than 85% agreeing or strongly agreeing that they had acquired a better understanding of those two topics as a result of participating in the negotiation process. Members of the Pacific Offshore Cetaceans team and responses of facilitators and federal employees had the highest proportion of responses that were agree or strongly agree. Roughly one-fifth of the members of the Atlantic Large Whale team and responses of scientific researchers, however, were neutral, disagreed, or strongly disagreed.

### **2.3.4 Fairness (FAIR)**

General perceptions of fairness were remarkably high. Averaged perceived fairness across all teams was 93%, and all members of the Pacific and Atlantic Offshore Cetaceans teams believed the process was fair. Although the Atlantic Trawl Gear and Pelagic Longline teams had the lowest scores, their average perceived fairness was still quite high (90%). Nearly 95% of the responses suggested stakeholders believed they were given the opportunity to express their views, with members of the Pacific Offshore Cetaceans team and responses by fisheries management council/commission members most strongly agreeing. A slightly lower percentage of responses showed members took the opportunity to express their views (90%), while almost 96% believed that others had an opportunity to express their views. All factor loadings of the measurement indicators were significant. Factor loadings were similar to the scaling indicator MYVIEWS (Figures 4 and 6), meaning that stakeholders' opinions of fairness of the negotiation directly affected their opinions about expressing their views and the opportunity of others to express their views in nearly a one-to-one relationship. No independent predictors significantly influenced the FAIR latent variable (Figure 4), indicating that regardless of Take Reduction Team membership or stakeholder affiliation, respondents had similar views of fairness.



### **2.3.5 Satisfaction with the Take Reduction Plan (TRP SAT)**

Perceived fairness of the negotiation (FAIR) significantly influenced stakeholder satisfaction with the Take Reduction Plans ( $\gamma=0.44$ ,  $p = 0.000$ ). The SEM identified five Take Reduction Teams as significant covariates of TRP SAT (Pacific Offshore Cetaceans, False Killer Whale, Bottlenose Dolphin, Pelagic Longline, and Harbor Porpoise Plan). All regression coefficients were positive (Table 15). An average of 66% of the responses indicated stakeholders were satisfied with the Take Reduction Plans. The Pacific Offshore Cetaceans and Bottlenose Dolphin teams had the highest average ratings of 89% and 80% respectively. Members of the Atlantic Large Whale team were the least satisfied with the Take Reduction Plan (45%) in which an average of 22% disagreed or strongly disagreed with the two questions used to measure this latent variable.

**Table 15: Regression coefficients, standard errors and two-tailed p-values of SOCAP, TRP SAT, and PCD ECO on covariate predictors (Models 1 and 2); and regression coefficients for the endogenous latent variables TRP SAT and PCD ECO for Model 3. The regression coefficient for PCD ECO on FAIR shows the indirect effects of fairness on the perceived ecological success. BD=Bottlenose Dolphin, FKW=False Killer Whale, HP=Harbor Porpoise, PL=Pelagic Longline, POC=Pacific Offshore Cetaceans, NE U.S.=Northeastern U.S.**

Model	Variable	Regression Coefficient	SE	Two-tailed p-value
Model 1	SOCAP ON			
	BD	0.55	0.19	0.003
	HP	0.40	0.13	0.002
	PL	0.48	0.20	0.014
	Fed	0.55	0.20	0.006
	TRP SAT ON			
	BD	0.62	0.16	0.000
	FKW	0.73	0.30	0.016
	HP	0.45	0.15	0.003
	POC	1.20	0.30	0.000
	PL	0.48	0.23	0.038
Model 2	PCD ECO ON			
	Age	0.01	0.00	0.000
	NE U.S.	-0.67	0.17	0.000
	Researcher	-0.77	0.25	0.002
	Environmentalism	-0.68	0.30	0.022
Model 3	TRP SAT ON			
	FAIR	0.52	0.07	0.000
	PCD ECO ON			
	TRP SAT	0.66	0.10	0.000
	FAIR*	*0.34	0.07	0.000

\* standardized indirect effects

Less than 60% of responses indicated participants believed the Take Reduction Plan incorporated their views. Members of the Atlantic Large Whale team were the least satisfied (25% disagreed or strongly disagreed), and roughly equal proportions of responses by environmentalists and fishermen (18% and 19% respectively) also felt the Take Reduction Plans did not incorporate their views (disagree or strongly disagree). Conversely, 90% of the members of the Pacific Offshore Cetaceans team agreed or strongly agreed.

Despite the general lackluster views of plan elements, more than 70% of the records showed stakeholders believed the consensus-based Take Reduction Plan was better than if NMFS created the plan without Take Reduction Team input. Of these, members for the False Killer Whale and Pacific Offshore Cetaceans team felt the most positively, while 18% of the members of the Atlantic Large Whale team and 20% of responses by environmentalists disagreed.

#### **2.3.6. Perceived Ecological Success (PCD ECO)**

Both factors (marine mammal BYCATCH and ABUND) loaded significantly on perceived ecological success (PCD ECO) with high reliabilities (Table 10), indicating that changes in the latent variable would directly affect each observed indicator, the latent variable accounts for a substantial portion of the variance in BYCATCH and ABUND,

and the internal consistency ( $r^2$ ) of the responses to each question was high. Team age was the only covariate that had a significant, positive effect on the latent variable. Members of older teams viewed the Take Reduction Plans as more effective than members of newer teams. The other significant, independent predictors (Northeastern U.S., researcher, and environmentalist) had negative regression coefficients (Table 15). Members of these groups believed the Take Reduction plans did not substantially reduce bycatch or increase marine mammal abundance.

More than three quarters of the responses indicated participants believed the plans were at least slightly successful in reducing bycatch and increasing marine mammal abundances. The Pacific Offshore Cetaceans team members reported the highest perceived ecological success (90%), while members of the Pelagic Longline team had the lowest average ratings (58%).

Perceived impacts to bycatch were nearly identical to overall perceived ecological success; more than 75% of the responses indicated that effects on bycatch were at least slightly successful. The Atlantic Trawl Gear team implemented a Take Reduction Strategy (voluntary research and education measures) and the plan for the Atlantic Offshore Cetaceans team was never implemented. Therefore, these teams did not affect bycatch because they both lack an active Take Reduction Plan. Removing responses from those two teams (that do not have Take Reduction Plans) increased the

perceived success of reducing bycatch to 83%. Responses by fishermen and members of the Pacific Offshore Cetaceans team revealed they believed the plans had been most effective at reducing marine mammal bycatch, while nearly half of the environmentalist responses did not believe the plans had any effect on bycatch.

Responses revealed that stakeholders were much less certain about effects of the plans on the abundance of marine mammal stocks, with over 25% responding “I don’t know.” Of the remaining responses, a large proportion (80%) of the Harbor Porpoise and Pacific Offshore Cetaceans teams, fishermen, and state managers believed the plans have increased marine mammal abundance, while nearly 65% of responses by environmentalists believed they have had no effect.

### **2.3.7 Full Conceptual Model of Perceived Take Reduction Team/Plan Success**

Stakeholder satisfaction with consensus-based marine mammal Take Reduction Plans was shown to directly affect their perceptions of plan success ( $\beta=0.66$ ,  $p=0.000$ ). Furthermore, participant beliefs about the fairness of the negotiation were shown to directly influence their satisfaction with the plan ( $\gamma=0.52$ ,  $p=0.000$ ). Thus, opinions about the fairness of the negotiation were shown to indirectly affect perceptions about plan success as mediated by satisfaction with the plan ( $\gamma=0.34$ ,  $p=0.000$ ). Shared learning and social capital (SOCAP), however, were not shown to directly affect perceptions of either

the output (plan) or outcome (success). There is, however, a significant association between the two latent variables SOCAP and FAIR ( $\phi = 0.50$ ,  $p = 0.000$ ).

### **2.3.8 Perceived Economic Impacts to Fishermen**

Most survey responses revealed that stakeholders believed the Take Reduction Plans have made the livelihoods of fishermen at least slightly worse. They showed that fishermen regulated by the Atlantic Large Whale and Harbor Porpoise teams suffered the greatest economic hardships, while a third of the Pacific Offshore Cetaceans team members thought that the livelihoods of fishermen were slightly better (Table 16).

Nearly all of the responses by fishermen and three quarters of those by state managers and fisheries managers thought the Take Reduction Plans had a negative economic impact on fishermen. Responses by environmentalists, however, were more skeptical with 80% believing that the Take Reduction Plans have had no effect on the livelihoods of fishermen.

**Table 16: Responses to survey question about the effects of marine mammal Take Reduction Plans on the livelihoods of fishermen, by Take Reduction Team (top) and stakeholder affiliation (bottom).**

LIVLIHOOD	ALW	ATG	BD	FKW	HP	POC	PL	AOC	Total
<b>Much worse</b>	10%	0%	3%	0%	7%	10%	0%	10%	6%
<b>Somewhat worse</b>	25%	6%	11%	42%	27%	10%	21%	30%	22%
<b>Slightly Worse</b>	43%	18%	51%	8%	48%	20%	16%	10%	36%
<b>No Effect</b>	14%	76%	23%	42%	14%	30%	58%	50%	29%
<b>Slightly better</b>	4%	0%	3%	8%	2%	30%	0%	0%	4%
<b>Somewhat better</b>	4%	0%	6%	0%	2%	0%	5%	0%	3%
<b>Much Better</b>	0%	0%	3%	0%	0%	0%	0%	0%	1%

LIVLIHOOD	Researcher	Fishing Industry	Environmental	State	Federal	FMC	Facilitator	Total
<b>Much worse</b>	0%	20%	0%	0%	2%	0%	0%	6%
<b>Somewhat worse</b>	14%	45%	6%	24%	9%	38%	0%	22%
<b>Slightly Worse</b>	38%	29%	17%	76%	26%	38%	25%	36%
<b>No Effect</b>	32%	4%	78%	0%	53%	13%	25%	29%
<b>Slightly better</b>	11%	0%	0%	0%	4%	13%	25%	4%
<b>Somewhat better</b>	5%	2%	0%	0%	4%	0%	25%	3%
<b>Much Better</b>	0%	0%	0%	0%	2%	0%	0%	1%

## **2.4 Discussion**

Most stakeholders who participated in marine mammal take reduction planning believed the plans were at least slightly successful at reducing marine mammal bycatch and increasing stock abundances. Nearly half believed they were somewhat successful. Given that nearly half of the respondents participate on more than one team and the majority have participated in at least four meetings reveals their commitment to the process. In addition, the meetings are resource-intensive to both the agency and

stakeholders. It stands to reason that members would believe that their investment has been at least somewhat worthwhile (Coglianese, 2003).

Stakeholder opinions about ecological success were influenced by their satisfaction with the final Take Reduction Plan and this satisfaction depended, in part, on their belief that the negotiation was fair. Irrespective of stakeholder affiliation or team membership, respondents overwhelmingly deemed the negotiations as fair. In addition, responses indicated that most participants engaged in shared learning, had an improved understanding of the viewpoints of others, and established new and long-term relationships with others who have differing opinions from their own. Team, stakeholder affiliation, and U.S. geographic region significantly influenced the latent variables. Members of the Bottlenose Dolphin and Pacific Offshore Cetaceans teams consistently had high, positive ratings of all the latent variables, while members of the Atlantic Large Whale team had the most pessimistic views of the process, outputs, and outcomes.

#### **2.4.1 Shared Learning and Social Capital (SOCAP)**

Interview subjects discussed factors affecting social capital including participants, information, creating new relationships, and leadership (Ansell and Gash, 2008; Beierle and Konisky, 2000; Dukes, 2005; Holmes and Scoones, 2000).



#### 2.4.1.1 Take Reduction Team participants

A committed membership is critical to the success of consensus-based negotiations (Holmes and Scoones, 2000; Innes and Booher, 2004; Susskind and McMahon, 1985). Absent their commitment, participants will resort to their best alternative to the negotiation by going outside the process to achieve their policy goals (Susskind and Cruikshank, 1987; Susskind and McMahon, 1985). Although the MMPA broadly defines which interests sit at the negotiation table, NMFS chooses the individual participants. Membership criteria focus on recruiting participants who have high social capital within their respective constituent groups, are knowledgeable about their field, are able to communicate well, and are capable of working collaboratively with a broad range of constituencies (L. Engleby, pers comm). Almost half of the survey respondents (44%) participated on multiple Take Reduction Teams. These experiences can be helpful in moving the process forward, especially when the number of qualified or interested members is limited. Members commented on the amount of experience they thought was important for the negotiations.

*“I think it’s important to have good people on each team. There’s certainly an incremental benefit to serving on multiple teams because you understand the way the process unfolds...so there’s certainly an advantage to being on multiple teams but I don’t think it’s necessary. I think in some ways it might be healthier if there was a greater diversity of people on different teams, but there is a limited number of people with the requisite knowledge and interest in doing that.” – Researcher*

Many stakeholders have served on a team since its inception, which can be as long as 18 years. The majority of survey respondents (66%) participated in at least four meetings and/or webinars. Because of the complexity of information, some advocated for maintaining experienced members.

*"I think it really makes a lot of sense that members that have been on the team for a while remain if they like to because it takes a while to understand the system and how it works and to understand the issues and what you need to do. You can't be just bringing in new members all the time ... you'd just be starting all over, all again, all of the time." –Researcher*

Others feel a diverse mix is best, which can mitigate "group think."

*"I think teams benefit from having a certain amount of that membership that has institutional memory, but I also think that it gets stale if there's never any new blood coming in... So I think it, the strongest teams have both elements. They have an institutional memory that's important and also new blood coming in." – Environmentalist*

But some less experienced members may feel frustrated and excluded.

*"Overall the Take Reduction Team process is very political. Those who are advocacy professionals end up pushing their points through because they repeatedly are on the teams and know the process and the people well... Perhaps the Take Reduction Team process does not operate as Congress intended. If one is not a professional Take Reduction Team operator, it is very difficult to be as involved in it as those who do it for a living." –Researcher*

Due to the large number of stakeholders involved in marine mammal bycatch, only a few representing each interest can sit at the table. Including all affected parties

can result in a very large group that is unable to achieve consensus, like the Atlantic Large Whale team (Holmes and Scoones, 2000).

*"It's like you can't really get to know those individuals and really understand all of their perspectives because everyone has such a limited amount of time to actually speak when you're around the table when there's that many people. So personally for me I feel less connected to that team because of its size, I mean the sheer size of the team." –Federal employee*

*"It's so large that it's difficult to, you know, you don't get some sort of intimate camaraderie going because of the sheer number of people... I think that some people shut down because of the size of the group. They don't like speaking in front of 45 people. They feel intimidated... It should be called the LARGE Atlantic Large Whale Take Reduction Team." –Fisheries Manager*

Team membership can change over time. Active fishermen who retire and leave the teams are often replaced with fishing industry representatives and lobbyists, which can affect the consensus-based negotiation. The diminishing number of active fishermen concerns some stakeholders who feel that fishermen are critical to the negotiation process.

*"I feel that an active fisherman should be at the table, somebody who's got a lot of self-interest and understanding of where the fishery is going." –Fisherman*

*"... We need to have people who use the gear, who are on the water, who could speak to the way the gear is operated, and the way they interact with gear and animals. And if that doesn't happen also I think the process will fall apart." –Researcher*

*"I've observed lobbyists suppress conversations and the exchange of ideas. Fishermen have told me that lobbyists...discourage them from talking or negotiating for compromise." –Federal employee*

Moreover, fishermen were viewed as valuable problem-solvers.

*“...when it came down to developing strategies to reduce take, that was something that the fishermen could do. That was what they do. They’re problem solvers. They deal with problems throughout their fishing activities. It’s all about solving problems and so when it came down to that aspect of it, that’s when they’re in their territory. That’s what they’re good at...” –Fisherman*

*“I’m more focused on how the to fix the problem, or perceived problem, and how I could show that if I’ve put, done something with our gear configuration or something that the whales, like putting up a sign hey whale don’t mess with me. I focus more on that.” –Fisherman*

#### **2.4.1.2 Information – empirical issues**

Differences in lay and scientific information can reduce trust among the negotiating parties and between the stakeholders and government institutions (Gray et al., 2012; Skogen, 2001). Shared learning helps participants search for common values which can decrease conflict while building trust and social capital among team members, as well as between participants and government institutions (Gunton et al., 2003; Innes and Booher, 2004). Ideally, this increased understanding of the issues also facilitates creative problem solving, improves decisions, and ultimately improves environmental outcomes (Dietz and Stern, 2008; Innes and Booher, 2004).

To facilitate knowledge sharing, approximately one-third of the negotiation time of face-to-face Take Reduction Team meetings centers on discussing empirical issues about fishing effort, marine mammal stocks, serious injuries, and mortalities. Members

are provided with myriad pre-meeting materials with relevant background information. Most interview subjects believed that despite existing data gaps, they were provided with the best available information. The best available information, however, may not be enough to enable productive negotiation or practical outputs.

*“Yeah I think that the hardest thing that we struggle with on any Take Reduction Team around the country probably struggles with is that there is very little really, really good population data... So you have two opposing sort of views and if you have uncertainty, especially in the population estimate, then those two groups can use the uncertainty as an arguing point for their side... So it just makes it a lot more potentially contentious and much more uncertain on how we’re doing as a group when we just don’t have the good population estimates and the trends.” –Researcher*

*“The whole notion of expanding out mortality or extrapolating mortality from catch, from landings, has irritated everybody since day one. You go out and catch no animals, catch no fish but you catch a dolphin in that one, and that extrapolates out to a huge number.” –Researcher*

Members of the Bottlenose Dolphin team stood out because 100% of respondents affirmed that as a result of the negotiations, they gained a better understanding of the fisheries involved and despite information challenges about stock structure, nearly all (98%) gained a better understanding of marine mammal bycatch and have created measures to reduce it.

*“the data’s not as good on all of the different populations of bottlenose dolphins we have to work with but I think the fishermen have been cooperative in trying to come up with useful measures...” –Federal employee*

Unfortunately, it can be challenging for new members to get up to speed.

*“... every meeting, I gain more knowledge. I gain more knowledge, and we have more understanding of it. And for someone to walk in green, it’s a very hard process.” –Fisherman*

#### **2.4.1.3 Establishing relationships and a sense of camaraderie**

As they’ve gotten to know one another, many respondents noted they had become more comfortable with other members over time, which has altered preconceived notions about particular stakeholder groups and facilitated a more open dialog.

*“...rather than having an abstract idea of what that person represented, you were dealing with a person and all of the complexities and emotions and so forth and so on, that comes with face-to-face dealings. So I think it’s much harder to maintain kind of an abstract distrust of somebody when you’re working with them and that distrust doesn’t really manifest...” — Fisherman*

As a result of the negotiations, approximately 95% of survey respondents on the Bottlenose Dolphin and Harbor Porpoise teams felt they had a better understanding of the perspectives of others, and 80% of Harbor Porpoise team members and federal employees made new, long-term relationships with members who had differing viewpoints. This corresponds with the findings of Leach et al. (2002), Frame et al. (2003), and Gunton et al. (2003). The Harbor Porpoise team evolved from a working group established in the early 1990s by fishermen, environmentalists, and scientific researchers to investigate alternative methods to reduce harbor porpoise bycatch (Smolowitz and

Wiley, 1992). Until 2012, the Harbor Porpoise team had included several members from this initial working group and successfully achieved consensus-based plans.

*"I would say that the strongest sense of camaraderie I've had was early on with the Harbor Porpoise team when it was first formed." –Researcher*

*"I have people on the Harbor Porpoise team I think I know particularly well and work with well." –Federal employee*

#### **2.4.1.4 Leadership**

A broad range of interviewees identified fellow teammates other than facilitators who took on a neutral, leadership role to help move the negotiations forward. Interview subjects identified these people as being respected by members from multiple stakeholder groups who helped to focus the discussion on consensus-based items and hammer out details of those items. They have a reputation for working well with members who have opposing viewpoints and negotiating in good faith.

*"I certainly have seen that from a couple of people, not really advocating for one position or the other, but trying to get us to the kernel of the issue. I've seen that before." –Fishing industry*

*"I think in any of these processes people, even when everybody at the table has an equal voice and you're operating under consensus, leaders tend to emerge and ...people who are either outspoken, or who have an ability to synthesize, or an ability to articulate a position well, or can bring members together to form a cohesive block within one of the teams tend to emerge as leaders and get listened to more. I think ... that will happen in any group process whether you're a jury, or Take Reduction Team, or a city council." –Researcher*

## 2.4.2 Fairness (FAIR)

Results from the survey, the SEM, and the interviews confirmed that regardless of stakeholder affiliation or team membership, Take Reduction Team members universally believed the negotiation process was fair. The survey questions characterized fairness as the equal opportunity for members to express their views.

*“Everyone has their chance to speak. And if you don’t speak...that’s your fault.”*  
–Fisherman

In addition, some interviewees interpreted fairness as the inclusive process of involving multiple stakeholders to reach consensus-based decision.

*“I mean the fairness comes in the involvement, comes in the fact of getting everyone in the room and having a negotiated discussion about the problem. If there is a problem there, I think that the process is, the particular Take Reduction Team process is the best problem-solving approach the NMFS has in all of its fisheries and protected resource arenas.”* –Fisherman

### 2.4.2.1 Facilitation

Employing skilled, neutral facilitators is critical to achieving fairness. Several theories about conflict resolution identify the importance of a neutral, third party in bringing together stakeholders with opposing viewpoints (Harter, 1982; Sabatier, 1988; Susskind and McMahon, 1985; Weible et al., 2009). The facilitator’s goal is to help the stakeholders achieve consensus while remaining impartial. To help achieve consensus, one role of facilitators is to conduct pre-negotiation interviews to determine the various



stakeholder interests (Susskind and McMahon, 1985). During the negotiations, they encourage caucusing and establish working groups consisting of the full range of viewpoints to tackle different issues (Susskind and McMahon, 1985). After the negotiations, effective facilitators compile and circulate detailed minutes for review and comment by the members (Susskind and McMahon, 1985). Since their inception, Take Reduction Teams have been facilitated by professionally trained, neutral, third parties hired by NMFS as government contractors. Previously, facilitators differed by team, but currently all teams are facilitated by the same contractor. The current facilitators allow all members to comment on and provide feedback on Take Reduction Team meeting summaries prior to finalizing and distributing the document.

*“...the facilitator was a professional in [that] they were used to that kind of tension and sort of cross-currents of negativity or whatever that were probably pretty typical in a mediation/arbitration kind of like environment. So I think that they helped tremendously in keeping the process moving in a direction and not getting hung-up whenever it did breakdown and you get emotional about some particular issue. That was probably the most important aspect of the process, to me, was the fact that there were professionals mediating it.” –Fisherman*

### **2.4.3 Take Reduction Plan Satisfaction (TRP SAT)**

The SEM found that perceived fairness of the consensus-based negotiation significantly influenced satisfaction with the Take Reduction Plans. Interviews confirmed this finding.

*“Yeah, they’re better [the Take Reduction Plans] because of the Take Reduction Team process. They’re better because of the TRT process...” –Fishing Industry*

However, satisfaction with the plans was not nearly as high or consistent among stakeholders as their views of fairness. Survey questions showed other factors that influenced satisfaction with the negotiated agreement included general opinions about consensus-based decision-making and feeling listened to or validated by having one’s viewpoints incorporated into the final plan.

#### **2.4.3.1 Consensus-based decision-making**

As defined by statute, marine mammal Take Reduction Teams make decisions by consensus. Members know that if they do not reach consensus, the agency will create regulations that may run counter to their interests. Participants are largely supportive of this consensus-based process and prefer it to the alternative (Table 17). Susskind and McMahon (1985) found that stakeholders preferred to help create a rule than comment on what they perceived as the agency’s predetermined decision; and a survey by Frame et al. (2003) of stakeholders that participated in collaborative land-use planning documented high satisfaction with the process over traditional methods.

**Table 17: Percent of total responses to the question if marine mammal Take Reduction Plans are better than if NMFS created the regulations on its own.**

TRPBETTER	Total
Strongly Disagree	2.4%
Disagree	5.2%
Neither	19.3%
Agree	41.0%
Strongly Agree	32.1%

*"...the federal people would do more than just like a scalpel, they would use a broad sword."* –Fisherman

*"Without a team that even argues for another side, then the agency's going to go with whatever is their least problematic direction... And I think that's what happens is they figure out what their calculus is. They do it all the time."* –Environmentalist

*"...I must also say that the process of stakeholder-driven rulemaking and an emphasis on consensus (with the threat of NMFS writing the regs if consensus was not reached) are very powerful tools and they should be used more in federal rulemaking, especially for complex issues that have potential to have significant effects on communities. Involving stakeholders in discussions with regulators, NGO, and scientists helps create a process whereby different needs, values, and perspectives are taken into account and people can work together to solve tough problems."* –Federal employee

Many believed that engaging the affected parties to help create the regulations to which they will be held accountable is paramount,

*"...you can't just write a law and put it in front of the fishermen and say this is the way you've got to do business or you're out of business, because as an industry there would be a lot of pushback."* –Fisherman

*"It is people who are living the situation [who] have an understanding that regulators don't have. And so to put the people impacted by the regulation in the*

*same room with the people who know how to write enforceable regulations, if it's well facilitated, well mediated, will lead to a product that is more aligned with the realities of the situation."* –Facilitator

While supportive of consensus-based negotiation, members also identified some frustrations, including and the ability of an individual to prevent the process from moving forward and the pitfalls of agreeing to potentially ineffectual, low-hanging fruit, as mentioned by Coglianese (2003) and Holmes and Scoones (2000).

*"...sometimes the whole idea of consensus, having a consensus before we can move forward is very difficult because it allows somebody... to completely hold up the ability for the group to move forward in any manner by just refusing to agree with everybody else on whatever topic you are talking about."* – Researcher

*"I do think there tends still to be an element of the take reduction planning process that leads to meaningless measures, particularly non-regulatory measures, that people feel good about but don't actually do anything. And sometimes that can be in the regulatory processes as well."* –Researcher

In addition, some fishermen expressed frustration with the potential for other stakeholders to dictate the future of their livelihoods.

*"I have trouble with it [consensus] because when you got 20 people discussing one man's livelihood and, and any discussion that they do, that livelihood can be taken away from him, with people that doesn't have any idea of what's going on..."* –Fisherman

*"I understand consensus but I also understand at the end of the day is the sacrifice that the fishers are giving up, or could be giving up, based on somebody else's want, not what's needed."* –Fisherman

#### **2.4.3.2 Buy-in**

The success of a consensus-based agreement relies on stakeholders who are committed to the terms of the final outcome, which can also facilitate adherence to those terms (Balint et al., 2011). Ideally, the Take Reduction Plans incorporate the concerns and perspectives of all members, which should increase the likelihood of compliance (Gunton et al., 2003; Holmes and Scoones, 2000). Interview subjects recognized the importance of stakeholder buy-in and its effects on implementation of the plans.

*“It’s also important for buy-in, in terms of compliance. If they feel like a plan was developed with their input and it took into account the things that were important to them, then they would be theoretically more inclined to comply with that plan.” –Federal employee*

*“Well I think that fishermen buy-in is a huge part of this process. If the fishermen don’t buy into it, it’s a lot less likely to have any real impact, produce anything successful I think.” –Fisherman*

#### **2.4.3.3 Feeling listened to – stakeholder opinions included in the final plan**

Absent buy-in, stakeholders are less likely to have a sense of loyalty to the process and are thus more likely to employ political or legal tactics to further their interests (Balint et al., 2011; Susskind and McMahon, 1985). Although members overwhelmingly deemed they and others had a fair opportunity to express their views and took that opportunity, fewer believed the agency listened to them by incorporating their views into the final plan, with less than 60% of the responses indicating they

agreed or strongly agreed. More than 60% of the members of the Atlantic Large Whale team were neutral or felt their opinions were not included in the Take Reduction Plan. On the other hand, roughly half of the members of the Atlantic Trawl Gear team (who generated a Take Reduction Strategy of voluntary measures) and the disbanded Atlantic Offshore Cetaceans team felt the final outputs incorporated their views. Members of the Pacific Offshore Cetaceans team responded most positively where 90% felt the final plan comprised their ideas. Among the stakeholder groups, the most frustrated included fishermen and environmentalists, among which nearly 20% of the responses for each group showed they did not believe their opinions were incorporated into the final Take Reduction Plan.

*"I mean this is the way that they should be doing it, getting the perspective of the industry and the scientists, the state managers, but I don't think that they're really listening to us... We're in such a quandary with lack of data and the need to do something, that they are just shooting with whatever they've got and I just don't think they are thinking clearly. So I think that Large Whale plan is pretty unfair..." –State manager*

*"I think to a certain extent recently in the Harbor Porpoise plan... I think we were close to making recommendations and again that's an instance where they essentially listened to the fishermen... the Fisheries Service wanted an easy out and so they just ignored it and went ahead with their, a proposal that they wanted to do. In essence I think they did not listen to what the majority of the team recommended." –Federal employee*

By and large, however, the majority of people believed their views were incorporated into the final plan.

*"Yeah. I think everybody gets listened to."* –Fisheries manager

*"We end up writing these things to try to represent the general consensus of everybody in the room, and by and large I think it really does capture that."* – Researcher

#### **2.4.4. Implementation – Compliance and Law Enforcement**

Consensus-based outputs only can be effective if the regulated parties comply with them, and compliance can be contingent upon enforcement. Penalties for violating the agreement must be high enough to elicit compliance. However, if the regulated parties know the outputs will not be enforced, the penalty structure becomes irrelevant (Colby, 2003). Interview subjects commented on their perceptions of plan implementation, specifically in reference to compliance and enforcement. Plans varied widely in their perceived enforceability and feasibility of implementation. Most interview subjects of the Pelagic Longline team (70%) mentioned that one of the plan requirements (20 nautical mile mainline length) was not enforceable.

*"Probably the main line length is difficult [to enforce] because the Coast Guard doesn't haul gear. We don't haul gear. There are sometimes we might, but we have to be there when a fisherman is hauling it. So we're just, we're using logbooks essentially."* –Federal employee

*"The biggest problem there is enforcement, and at-sea enforcement... It's very difficult to determine how long a pelagic longline is 'cuz they set a buoy here, they set a buoy here, on each end possibly, and then you get, you know, bows in the set due to currents and bottom topography or whatever."* –State manager

Members of the Atlantic Large Whale team also felt that their plan could not be enforced.

*“There really wasn’t [enforcement] because the Coast Guard, unless they’re there when you’re hauling gear, then that’s something else, but they have no way of pulling gear themselves and looking at it. So there was really very little enforcement of any of these provisions.” –Environmentalist*

*“The Large Whale plan is very challenging to fully enforce because you’ve got such a wide geographic spread.” –Facilitator*

*“I think that the Northeast team, for the Large Whale team, I think those, the plan is essentially unenforceable. It’s just too complex. They make up regulations that look good on paper but are virtually impossible to enforce like how many traps you have on the end of a line. I mean the Coast Guard will tell you, you can’t enforce that.” –Federal employee*

The Harbor Porpoise plan had a different problem. The requirement to use acoustic deterrence devices (pingers) on gillnets is somewhat enforceable. Officers can check to see if fishermen have the required number of pingers, but cannot easily determine if they are functioning properly. There was low compliance with the pinger requirement (Palka et al., 2012) that the team members attributed to a lack of enforcement.

*“On the Harbor Porpoise team, they get really gung ho about using the pingers and they’re super diligent, but then nobody’s checking them and so whatever, you know they just kind of fall off the wagon” –State manager*

*“And I think regardless of whether something that’s regulatorily required, if you don’t enforce it, it doesn’t exist. So that’s exactly what has happened with harbor porpoise.” –Environmentalist*



Regardless of enforceability, stakeholders widely believed that enforcement of most Take Reduction Plans was lacking because of limited staff and resources, and myriad responsibilities of law enforcement officers.

*“Enforcement is basically a fantasy.... Enforcement is, it’s just a big ocean out there. The Coast Guard has taken up homeland security issues. A huge amount of their time is occupied by competing interests with homeland security. And the NMFS enforcement has very few real enforcement agents on the water. It’s just a very small, a handful people really in each region. And it’s a big, big ocean out there. So the reality is that enforcement is not a real big deterrent.” –Fisheries manager*

*“NMFS relies way too heavily, they say it at every meeting, well we’re going to rely on our state partners for enforcement. And the ability of the states to do that varies.” –State manager*

*“...they [fishermen] just know that the Fisheries Service has got no enforcement agents and it’s probably a 99% chance that they’re never going to be inspected in the first place, and that 1% chance that they are inspected is not sufficient to convince them that they need to comply with the regulations.” –Federal employee*

## **2.4.5 Perceived Ecological Success**

Most significant covariates of perceived ecological success had negative regression coefficients. These included researchers, environmentalists, and teams where the stocks range in the northeastern U.S. (Atlantic Large Whale, Harbor Porpoise, Atlantic Offshore Cetaceans, Atlantic Trawl Gear), while older teams had a positive regression coefficient (Figure 5, Table 13). Scientists generally tend to be more deliberate about drawing definitive conclusions from uncertain data, often to avoid committing

Type I statistical errors (i.e., claiming Take Reduction Plans are effective when they are not – a false positive) (Buhl-Mortensen, 1996), and environmentalists tend to take a cautious position in the face of ecological uncertainty (Cincin-Sain and Knecht, 1998). These traits would lead them to respond more conservatively to questions about the success of Take Reduction Plans (Myers, 1999).

Members of teams in the northeastern U.S. also were skeptical about the ecological effectiveness of the Take Reduction Plans. There are two teams in the northeast that do not have active Take Reduction Plans and one very large team that has never come to consensus. These factors may have negatively influenced perceived ecological success. Conversely, members of older teams have had more time to interact with and get to know one another, thus increasing the likelihood of social capital and trust among the participants, which could improve perceived success. For example, Leach et al. (2002) found that age of watershed partnerships was an important predictor of their perceived success, where older teams believed they were more effective at addressing ecological problems than younger teams.

#### **2.4.5.1 Marine mammal bycatch**

Overall, marine mammal Take Reduction Team participants believed the Take Reduction plans have been at least slightly successful at reducing marine mammal

bycatch. The degree to which team members perceived the impacts of Take Reduction Team processes on bycatch varied by team and stakeholder affiliation. More than half of the members of the Atlantic Trawl Gear team believed bycatch had been unaffected by their actions. This team was convened as a result of a lawsuit settlement agreement (N.D. Cal. Apr. 30, 2003). Prior to convening the team, NMFS updated its marine mammal stock assessments and found that the stocks identified in the lawsuit did not exceed the MMPA threshold for convening a Take Reduction Team. Consequently, they created and implemented only voluntary research, education, and outreach measures as part of a Take Reduction Strategy. Likewise, nearly two-thirds of the respondents from the Atlantic Offshore Cetaceans team believed that bycatch has been unaffected by their actions because although this team created a consensus-based Take Reduction Plan, it was never implemented due to closures of two of the three fisheries that helped create that plan. Members who fought for consensus expressed disappointment and frustration about what happened.

*"I think the one that was probably the least fair and poorly handled was the whole Atlantic Offshore team... So you sit there and you negotiate in good faith and there's all this swirl around you, which really undermined the process. And it tends to make people really angry... You convene us, but you're not even giving us a good faith opportunity to make this right. And you're not even implementing the things we all agreed to, which those are hard negotiations." – Environmentalist*

Of the teams with active Take Reduction Plans, the least optimistic were members of the Pelagic Longline and Atlantic Large Whale teams. More than one-third of the members of the Pelagic Longline team believed their plan has had no effect on bycatch, and nearly one-quarter of the respondents on the Atlantic Large Whale team felt their plan has either made bycatch worse or has been ineffective. This may result from their perceptions about the enforceability of their plans and the large, complex nature of the problem.

*“Well for large whale, I don’t think so. I don’t know that much of that has worked... Again because it’s a huge, I mean you look at the nature of the problem. You get this vast amount of gear out there and no matter what you do, you’re going to have entanglements, even if you have the best gear reductions just because of the way the ocean works, the animal behavior, weather conditions, all these things coming into play.” –Fisheries manager*

*“Unfortunately I don’t think it [the Atlantic Large Whale Plan] has been particularly effective, in the sense that we’ve done what, 20 rulemakings, or however many? ...I also think that the effectiveness of the plans really gets down to the charge that NMFS gives the team, and in that case their charge was astronomical. It was reducing bycatch of three stocks in a gazillion fisheries, in, you know, the entire East Coast, and it was, it was really daunting. And it’s a huge job.” –Federal employee*

On the other hand, all members of the Pacific Offshore Cetaceans team believed marine mammal bycatch was somewhat or much better as a result of implementing their plan. More than half of the respondents on the Harbor Porpoise and Bottlenose Dolphin

teams also thought that implementation of their plans have made bycatch somewhat or much better.

*“I think Pacific Offshore Cetaceans has been incredibly successful. I mean when they first got together, there was a whole bunch of bycatch of beaked whales and like a whole bunch of other small cetaceans, and large cetaceans. It’s really tapered off.” –Federal employee*

*“I mean for most of the bottlenose stuff, the bycatch has in fact dropped substantially, just with the restrictions placed on the methods of fishing. And you would have to say that harbor porpoise was working for the same reason. Whenever they enforced it, the bycatch went way down. It would go back up when they didn’t, but then it would go down again.” –Environmentalist*

*“I mean just thinking about the numbers in the harbor porpoise plan. We are nowhere near, even though we’re still over PBR...” –State manager*

The most optimistic stakeholder groups regarding Take Reduction Plan effects on bycatch included fishermen and the facilitators. Nearly half of the responses by fishermen revealed they thought bycatch was somewhat better and more than 20% revealed it was much better, while 60% of responses by facilitators thought bycatch was somewhat better because of take reduction planning. As the regulated parties who have experienced personal and financial costs of altering their fishing practices and modifying their gear, it follows that fishermen would be more hopeful that their efforts were not wasted (Coglianese, 2003; Leach et al., 2002). Although they never mentioned this during their interviews, their daily experiences on the water may indicate to them that bycatch has decreased. At the same time, the facilitators work hard to help the teams

reach consensus-based decisions. Their optimism about the outcomes may echo their positive views of the process and outputs (Coglianese, 2003; Leach et al., 2002).

Moreover, facilitators tend to view multi-stakeholder partnerships as more successful than do other stakeholders (Leach and Sabatier, 1999).

*“Bycatch has diminished greatly, making stocks more abundant, thus making avoidance more difficult” –Fishing industry*

*“I believe that if we hadn’t done anything, you would see a whole lot more.” – Fisherman*

#### **2.4.5.2 Abundance of marine mammal stocks**

Stakeholders were less certain of the effects of the Take Reduction Plans on the abundance of marine mammal stocks, in which more than one-quarter of responses were “I don’t know.” This mirrors the large uncertainty associated with the stock assessment data discussed earlier. Of the remaining responses, nearly 40% believed that the plans have had no effect on stock abundances. Responses broke down into patterns similar to those for the effects on bycatch wherein a large majority of the members of the Atlantic Trawl Gear and Atlantic Offshore Cetaceans believed their plans have had no effect on stock abundances. The majority of the Pelagic Longline team participants and over one-third of the Atlantic Large Whale team respondents also felt their plans have not affect marine mammal abundances.

*“And the least successful plan is the Large Whale plan. And that’s a difficult one to solve. And even in the stock assessment reports, the agency cites published scientific literature showing that what they’ve done hasn’t worked, and yet getting anything to change is difficult... So that plan is like the old joke about a camel being a horse that’s designed by a committee. It just isn’t functioning the way it should for what we want to get out of it and it’s not going to because the agency cannot, does not feel politically it can do what it takes to make that problem go away. And so I think it’s not going to work.” –Environmentalist*

*“...there’s no question in my mind that one of the major reasons the population of right whales has grown as slowly as it has is because of the bycatch in the gillnets and crab pot lines. If you reduce that, you would increase the rate of growth and increase the size of the population.” –Federal employee*

Similar to the views about bycatch, members of the Pacific Offshore Cetaceans team had the most positive views, with 70% of their respondents believing that stock abundances are at least somewhat better as a result of their Take Reduction Plan. Just over half of the participants in the Harbor Porpoise team felt similarly.

*“Yeah I mean you can watch harbor porpoise. When the bycatch goes way down, I mean that’s a fairly responsive stock...they’re very responsive because of the life history of the animals...you can see if you use PBR as an indicator of stock abundance it will go up when the abundances up and go down when the abundance is down. You can watch the PBR fluctuate...based on what the bycatch is, and the bycatch fluctuates based on the people doing what they’re supposed to in the plan. So I think that species has given us hope that in fact these plans are doing what they’re supposed to do which is help species recover.” –Environmentalist*

*“I think the plan has improved abundance of harbor porpoise, but I am not sure its impact on other small or large cetaceans and pinnipeds” –Federal employee*

The two stakeholder groups who were most optimistic about the effects of their plans on marine mammal stocks included state managers and fishermen, while more than half of the responses by researchers and environmentalists revealed they believed the plans have had no effect on marine mammal abundance.

*“Look at the increase in the number of right whales in the north. It’s incredible how far we’ve come and yet we get zero credit for it because they just keep hammering for more and more and more. We went from I think under 300 animals when we started and we’re at probably over 400 by now, I don’t know but. Anyway, that’s a big increase in 10 years. So something is working.” – Fisherman*

*“They should. Yeah they should. I think that we don’t, we can’t point to any concrete examples of that because of the limitations in the stock assessment process. So we can’t point to any empirical evidence to suggest that that is the case.” –Researcher*

*“Yes. I do. Simply by reducing bycatch, there will be more animals out there...” –State manager*

#### **2.4.5.3 Effects of other fishing regulations and fishing effort**

Several interview respondents commented on the numerous fishing regulations to which fishermen must comply notwithstanding the marine mammal Take Reduction regulations. In addition to affecting the livelihoods of fishermen, changes in fishing effort and location also can impact marine mammal bycatch. For example, closure of the Atlantic pelagic driftnet and pair trawl fisheries and modification of the Atlantic pelagic longline fishery put many fishermen out of business and brought about the demise of



the Atlantic Offshore Cetaceans Take Reduction Team. Geijer and Read (2013) found that prior to implementation of the Harbor Porpoise Take Reduction Plan, bycatch was significantly correlated with cod landings in the Gulf of Maine sink gillnet fishery. Low compliance with the Take Reduction Plan requirements can mimic conditions prior to plan implementation. I conducted the same analyses for the period of 2008-2012 and found that bycatch was again significantly correlated with cod landings ( $r = 0.96$ ,  $p = 0.008$ ). Participants in this study echo these findings:

*“So the amount of gear in the water has been reduced quite a bit. I think that’s gone a long way to reduce, and these things were all factored into the Take Reduction Plans. I think some of the benefits that we see comes strictly through effort reductions, and that the effort that’s left out there is a much more difficult thing to regulate, to achieve the reductions that you’re looking for.”* –Fisheries manager

*“I think the problem is that what has mostly affected the effective fishing industry is not a consequence of a Take Reduction Plan. It’s because of the status of the stocks they are targeting that has required dramatic restrictions and therefore, any additive restriction on top of that is something they’re going to fight, which from a human point of view, I don’t blame them.”* – Environmentalist

#### **2.4.6 Perceived Effect on the Livelihoods Of Fishermen**

Almost two-thirds of survey responses indicated that stakeholders believed that Take Reduction Plans have made the livelihoods of fishermen at least slightly worse. Similar to members’ perceptions of the link between Take Reduction Plans and

ecological effects, most members of the Atlantic Trawl Gear team believed their Take Reduction Strategy has caused no economic impacts. Half of the members of the Atlantic Offshore Cetaceans team, however, believed that the team made the livelihoods of fishermen worse, a likely consequence of the closures and changes to the fisheries involved. Teams who most strongly expressed an opinion that Take Reduction Plans economically impacted fishermen included the Atlantic Large Whale and Harbor Porpoise, where more than one-third of the respondents believed that the livelihoods of fishermen were either somewhat or much worse because of the Take Reduction Plans (Table 16). More than half of the members of the Pelagic Longline team felt their plan had no effect on the livelihoods of fishermen, while 30% of the Pacific Offshore Cetaceans members thought that the livelihoods of fishermen were slightly better (Table 16).

*"I think probably the two most would be the pingers [Gulf of Maine harbor porpoise and Pacific Offshore Cetacean] and the sinking groundline [Atlantic Large Whale] and all that. I would say the least would have been the mid-Atlantic harbor porpoise because they really didn't have to do anything." – Environmentalist*

*"I think probably the greatest economic hardship is from the Large Whale plan because of the volume of the rope and stuff that they have had to buy, the gear mods that they've had to make but principally in the way they deploy and mark the gear has been a fairly significant cost to the industry." – Fisheries manager*

*"I think probably the most expensive cost in all these has been pingers. I think probably the harbor porpoise people trying to comply with the harbor porpoise bycatch problem have probably borne the greatest cost..."* –Federal employee

*"I don't think the, anyone in the Pelagic Longline team has been affected at all."*  
–Federal employee

Responses of nearly all fishermen indicated they thought their livelihoods have been made at least slightly worse, and 20% of responses showed they believed they were much worse. Similarly, all responses by state managers and most fisheries managers revealed they felt the Take Reduction Plans have caused at least a slight economic decline for fishermen. Nearly 80% of the responses by environmentalists, however, revealed they felt the plans have had no negative impacts to the livelihoods of fishermen. Responses by the interview subjects, though, were more muted. The fishermen and fishing industry members did not characterize the economic impacts to be as great a hardship as the survey respondents, and the environmentalists who were interviewed acknowledged that fishermen have experienced negative economic effects as a result of the plans. This could be a consequence of interview response bias or social desirability distortion, in which interview respondents tend to, "answer questions in a more socially desirable direction than they would under other conditions or modes of administration." (Richman et al., 1999, p. 755). Telephone interviews also can create social desirability distortion, eliciting more positive responses than other survey modes

(Ye et al., 2011). It is also possible that the web survey responses were more extreme as a result of the anonymity it provides in the absence of an interviewer (Kiesler and Sproull, 1986).

*"I believe that it's affected it some, now how much, because I mean my own little niche, in my general area right now, it's really not done as much as it could have, if we hadn't of done something as far as gotten NMFS without our input." – Fisherman*

*"Because most of them are consensus, you have to think that the fishing industry wouldn't agree to something that was going to put it out of business. So I would have to say it has an effect and there may be, to some extent, an adverse effect but it's sustainable based on the fact that the industry has agreed to it. I certainly wouldn't agree to something that was going to put me out of business. I would be fighting it tooth and nail." –Environmentalist*

*"So yeah, I mean there's been an impact. There's a gear cost. There's operational costs. There's changes in fishing practices but I think that it'd be hard to completely quantify to be honest with you because it's the cost of doing business. As long as it hasn't been anything too punitive or unjustified scientifically or otherwise, then guys have learned to live with it." –Fishing industry*

## **2.5 Conclusions**

Results of the three modes used to investigate participant views of marine mammal take reduction planning - survey, SEM, and semi-structured interviews - converged on several topics. The participants in this study felt positively about the Take Reduction Team negotiation process. Survey results indicated that more than 80% of the respondents learned more about the opinions of their fellow teammates, created long-

term relationships with members who have opposing viewpoints, and through shared learning, learned more about the fisheries and marine mammal stocks they were regulating. Interview participants also expressed feelings of camaraderie with their team members. This built trust and created social capital during facilitated negotiations in which nearly all members felt they and others had a fair opportunity to participate. While the survey showed that an average of 93% of the participants felt the process was fair, the SEM showed that these feeling did not differ significantly by team or stakeholder affiliation. The SEM also revealed that participants' feelings about fairness significantly influenced their satisfaction with the Take Reduction Plans, but despite the consensus requirement, more than 15% of participants did not believe their opinions were incorporated into the final plans and 25% expressed no opinion (neither agreed nor disagreed). In addition, the SEM revealed that stakeholder satisfaction with the Take Reduction plans significantly influenced their perceptions of the plan's ecological effectiveness. Most believed the plans were at least slightly successful at reducing marine mammal bycatch and increasing abundance of marine mammal stocks, which is unsurprising given that majority of participants are satisfied with the Take Reduction Plans as well as the negotiation process.

One surprising result of the SEM was that social capital and shared learning do not directly influence participant satisfaction with the Take Reduction Plans. Rather,

changes in plan satisfaction directly affect stakeholders' feelings about creating relationships with members who have opposing viewpoints: the greater the satisfaction with the plan, the more positively people felt about their relationships. Moreover, social capital and shared learning co-vary with views of fairness, but one does not influence the other. Limitations of the SEM prevented inclusion of stakeholder opinions about the effect of the plans on the livelihoods of fishermen.

The interviews allowed me to explore topics that were not covered by the survey. For example, stakeholders discussed team membership and concern over the decline of active, working fishermen, especially on the Harbor Porpoise team. I also was able to explore some themes I observed during the Take Reduction Team meetings.

Interviewees provided some insights about how particular members take on neutral, leadership roles during the negotiations and how that affects the negotiation. They also elaborated on the need for stakeholder buy-in with the plans and frustrations with data limitations. In addition, I was able to explore stakeholders' opinions about plan implementation, compliance, and enforcement, which revealed frustration with a lack of enforcement and dissatisfaction with the enforceability of some plans. These views about implementation likely affect their views on plan performance. Stakeholders also elaborated on the impacts of fishing regulations to fishermen, marine mammal stocks, and Take Reduction Teams. Finally, opinions expressed during the interviews about the

effects of the Take Reduction Plans on the livelihoods of fishermen were not as staunch as those expressed in the survey, a possible consequence of response bias or social desirability distortion.

Regarding the relative differences of views among teams and stakeholder groups, members of the Pacific Offshore Cetaceans and Bottlenose Dolphin teams had the most positive views of Take Reduction planning, while members of the Atlantic Large Whale team were the most pessimistic. Environmentalists and researchers believed the plans have been neither effective nor ineffective at reducing bycatch and increasing marine mammal abundance. Fishermen and facilitators, on the other hand, were most optimistic about plan effectiveness.

A more comprehensive evaluation of marine mammal take reduction planning should examine the perceived effectiveness in conjunction with the ecological outcomes to identify areas of agreement and disagreement and how the process may be improved. This would address concerns about using stakeholder satisfaction as a proxy for ecological success. Satisfaction does not necessarily equate with good policy or the best environmental outcome, nor does dissatisfaction equate to bad policies and outcomes (Coglianese, 2003). Researchers should examine stakeholder opinions in the broader context of policy implementation and actual outcomes (Coglianese, 2003; Leach et al., 2002).

## **3. Chapter 3**

### ***3.1 Introduction***

Disputes about the use, conservation, or protection of natural resources vary in scope, scale, and intensity (Beierle and Cayford, 2002; O'Leary and Bingham, 2003).

Environmental conflicts can involve clashes over wildlife and fisheries management, land and water use, access to public lands and waterways, maintenance of ecosystem services, and air and water quality. These conflicts often arise because the public shares the costs of managing the resource, but only those individuals who exploit the resource experience its benefits - the Tragedy of the Commons (Hardin, 1968). Options to mitigate the Tragedy of the Commons can include privatization, collective action, local control, and government regulation (Axelrod, 1984; Hardin, 1968; Ostrom, 1990). In the U.S., the ways in which the government chooses to regulate the use of natural resources can be viewed to occur along a continuum. At one end lies the "command and control" method wherein an administrative agency proposes regulations, releases them for public comment, modifies those rules in response (or addresses the comments), and implements final rules. All citizens have an opportunity to submit comments, but commenting is typically limited to those individuals and groups most directly affected by the regulation and have spent time and resources staying abreast of agency actions.



Thus, the command and control style of regulation solicits the minimum amount of public input. At the other end of the continuum, stakeholders work directly with administrative agencies to devise regulations through consensus-based, multi-party negotiation, referred to as negotiated rulemaking (Coglianese, 1997; Funk, 1997). Various environmental agencies in the U.S. have embraced negotiated rulemaking including the Environmental Protection Agency, Department of Interior, and National Oceanic and Atmospheric Administration (NOAA) (Leach et al., 2002).

As discussed in Chapter 2, several ingredients are required for successful multi-stakeholder environmental regulation or negotiated rulemaking. The first is deciding which stakeholders can participate. Who is included or excluded from the process affects the likelihood of compliance, buy-in, and success (Beierle and Konisky, 2000; Conley and Moote, 2003; Holmes and Scoones, 2000; Rowe and Frewer, 2000). Second, using a neutral, third party to help guide the negotiations to focus on empirical issues and shared learning increases the likelihood of agreement and improves relationships, social capital, and fairness (Holmes and Scoones, 2000; Innes and Booher, 2004; Renn, 2006). Third, conducting several meetings in which stakeholders can interact over long timeframes increases cooperation (Axelrod, 1984; Gray et al., 2012). Last, requiring consensus-based decisions increases stakeholder investment in the process and the likelihood of compliance, decreases the probability of defection, and can produce

second-order benefits of increasing social networks and cooperation outside of the negotiation (Holmes and Scoones, 2000; Innes and Booher, 2004; Renn, 2006). Open communication in a deliberative process reduces information asymmetries and increases the transparency of how institutions make decisions. Direct participation by the affected parties should facilitate creative problem-solving and produce outputs that incorporate citizen values (Beierle and Konisky, 2000; Conley and Moote, 2003; Innes and Booher, 2004; Renn, 2006).

The environmental conflict resolution literature consists of a plethora of evaluative case studies of a vast array of conflicts ranging in scope and scale of the dispute (Bingham, 2003; Dukes, 2005; Leach et al., 2002). Some studies focus purely on the negotiation process, while others focus on outputs. Many focus on participant satisfaction with the process, which affects satisfaction with the outcomes (Chapter 2). Participant satisfaction, however, may not be a good measure of actual ecological outcomes (Coglianese, 2003; Dukes, 2005; Leach et al., 2002; Moore, 1996). Coglianese (2003) points out that to avoid cognitive dissonance, stakeholders involved in more intensive participatory processes like negotiated rulemaking, may have a more positive view of the outcomes than is warranted. To increase the likelihood that stakeholder views will closely track actual environmental outcomes requires a continuous feedback loop wherein institutions or researchers keep stakeholders informed about the status of

the ecosystem they are trying to influence. This feedback loop requires implementation of a standardized monitoring program, which can be resource intensive and logistically challenging to implement.

Finally, satisfying the regulated parties can create a perverse incentive.

Coglianesi (2003, p. 77) argues that “the kinds of regulations necessary to improve overall social welfare makes participants decidedly dissatisfied.” Thus, participants in negotiated rulemaking processes may be reluctant to agree upon measures that could be harmful to some of the parties. One way to mitigate this perverse incentive would be to involve a variety of stakeholders representing different and opposing interests through negotiated rulemaking. One such program is mandated by the Marine Mammal Protection Act of 1972 (MMPA, 16 U.S.C. 1361 et seq.), which requires negotiated rulemaking to mitigate the incidental capture or entanglement of marine mammals in fisheries, a process called bycatch.

### **3.1.1 Marine Mammal Take Reduction Plans**

#### **3.1.1.1 Marine mammal bycatch**

Each year, thousands of marine mammals in U.S. waters incur serious injuries or die as a result of interactions with fishing gear (National Marine Fisheries Service, 2011; Read et al., 2006). The life history characteristics and demographics of many marine mammals make their populations vulnerable to fisheries bycatch (Lewison et al., 2004;

Read, 2008; Read et al., 2006; Soykan et al., 2008). Typical of “slow” or K-selected species (Promislow and Harvey, 1990; Read and Harvey, 1989), many marine mammals mature late, reproduce slowly (single births) over long lifespans, invest high amounts of energy in rearing each offspring, and have high survival rates (Heppell et al., 2000; Heppell et al., 2005). This strategy is resilient to long-term environmental uncertainty but “slow” populations are vulnerable to even moderate rates of mortality due to their limited potential for population growth (Heppell et al., 2000; Heppell et al., 2005; Lewison et al., 2004). Thus, high bycatch rates can cause marine mammal populations to decline over short timeframes, but such declines can go undetected unless monitoring programs are in place (Lewison et al., 2004; Taylor et al., 2000; Wade, 1998).

Small or declining stocks are especially vulnerable to bycatch because they are less resilient to the effects of environmental, demographic, and genetic stochasticity. The bycatch of small populations is a relatively infrequent event, but even a few fatalities can have a dramatic impact on the health and persistence of the population (Read and Wade, 2000). Moreover, because fishermen may only rarely interact with or even observe these animals, implementing protective measures can be politically unpopular (Read, 2008).

### **3.1.1.2 Mitigating marine mammal bycatch**

Addressing marine mammal bycatch is challenging for a number of reasons. First, data collection frequently relies on observer programs that are costly and often unpopular because they require government observers to be placed on fishing vessels. Only half of U.S. fisheries have observer coverage of any kind, and many fisheries carry observers on only a small percentage of vessels (GAO, 2008). Second, enforcement of existing mitigation rules is challenging, even for near-shore fisheries. The federal agency charged with protecting most marine mammal stocks, NOAA, has only 146 special agents and 17 law enforcement officers to cover all federal waters (3 to 200 miles offshore). NOAA relies heavily on partnerships with the U.S. Coast Guard and state law enforcement agencies to enforce fisheries regulations ([http://www.nmfs.noaa.gov/ole/ole\\_about.html](http://www.nmfs.noaa.gov/ole/ole_about.html)). However, with more than 3 million square miles of open ocean and 85,000 miles of U.S. coastline, the amount of water to patrol far exceeds the available manpower ([http://www.nmfs.noaa.gov/ole/ole\\_about.html](http://www.nmfs.noaa.gov/ole/ole_about.html)).

One goal of the MMPA is to maintain marine mammal stocks at levels where they experience maximum productivity recognizing the environmental health and carrying capacity, a concept known as the Optimum Sustainable Population (OSP) level (16 U.S.C. 1362(9)). A unique feature of the statute is that it provides a specific formula

for calculating the number of animals that can be removed from a stock by human-related causes while still maintaining OSP (16 U.S.C. 1362(20)). This number is called the Potential Biological Removal (PBR) and the formula for calculating PBR is as follows

$$N_{\min} \times \frac{1}{2} R_{\max} \times F_r$$

where  $N_{\min}$  is the minimum population estimate,  $R_{\max}$  is the maximum potential population growth rate, and  $F_r$  is a recovery factor that accounts for endangered or threatened listing status of the species and uncertainties in the population estimate, mortality, and  $R_{\max}$  (16 U.S.C. 1362(20)). If the number of human-related deaths exceeds PBR, the MMPA defines that stock as “strategic” (16 U.S.C. 1362(19)(A)). Declining stocks and species that are listed as endangered or threatened also are considered “strategic” (16 U.S.C.(19)(B)(C)). Examples of marine mammal stocks currently deemed "strategic" include several large whale species, Gulf of Maine/Bay of Fundy harbor porpoises, many coastal stocks of Atlantic bottlenose dolphins, and Hawaiian false killer whales.

NOAA’s National Marine Fisheries Service (NMFS) drafts and implements regulations in support of the MMPA for cetaceans and all pinnipeds except the walrus. Each year, NMFS creates a List of Fisheries in which it evaluates the severity of marine mammal-fisheries interactions as frequent (Category I), occasional (Category II), or remote (Category III) (16 U.S.C. 1383a(b)). The agency also generates annual Stock

Assessment Reports in which it describes marine mammal abundance, population structure and trends, and human-caused mortality for each marine mammal stock (16 U.S.C. 1386). Three Regional Scientific Review Groups consisting of outside experts provide peer review of the Stock Assessment Reports and provide recommendations to the agency (16 U.S.C. 1386(d)). If bycatch of a strategic stock interacts with a Category I or II fishery, NMFS forms a multi-stakeholder Take Reduction Team.

Take Reduction Teams are charged with devising a consensus-based Take Reduction Plan comprising regulatory and non-regulatory measures to mitigate the bycatch (16 U.S.C. 1387(f)(6)(A)(i)). Take Reduction Teams consist of environmentalists, members of the fishing industry (fishermen, lobbyists, and industry group representatives), scientific researchers, members of Regional Fisheries Management Councils and Commissions, and state and federal managers (16 U.S.C. 1387(f)(6)(C)). Take Reduction Team meetings are facilitated by trained, professional, neutral, third parties. If the team is unable to achieve consensus, the MMPA requires NMFS to create a Take Reduction Plan (16 U.S.C. 1387(f)(7)(A)(ii)). The short-term goal of Take Reduction Plans is to reduce bycatch to below PBR within six months of implementing the Plan (16 U.S.C. 1387(f)(2)). The long-term goal is, within five years of implementation, to reduce bycatch to a zero mortality or serious injury rate (ZMRG), which is defined as 10% of PBR (50 CFR §229).

Since 1996, NMFS has convened nine Take Reduction Teams (Table 18). One team, the Atlantic Offshore Cetaceans, disbanded in 2001 because two of the three fisheries it addressed were closed by regulation. This team created a Take Reduction Plan, but it was never implemented. Two other teams, the Gulf of Maine and Mid-Atlantic Harbor Porpoise teams, merged to form the Harbor Porpoise Take Reduction Team. The Atlantic Trawl Gear Team was established as a result of a lawsuit (N.D. Cal. Apr. 30, 2003). Prior to team formation, NMFS updated the relevant stock assessments and found that the stocks were not strategic, which meant they did not warrant regulatory action (National Marine Fisheries Service, 2008). The team, therefore, created a Take Reduction Strategy that consists of voluntary research, education, and outreach measures (National Marine Fisheries Service, 2008). Thus, there are seven active Take Reduction Teams and six active Take Reduction Plans (<http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm>). Teams range in size and age (Table 18). The oldest teams were formed in 1996, while the most recent was established in 2010 (<http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm>).



**Table 18: Marine mammal Take Reduction Teams, team size, and age. Data gathered from <http://www.nmfs.noaa.gov/pr/interactions/trt/teams.htm>.**

<b>Marine Mammal Take Reduction Team</b>	<b>Team Size (members + alternates)</b>	<b>Team Age (Months)</b>
Atlantic Large Whale	82	221
Bottlenose Dolphin	46	158
Harbor Porpoise	42	227
Pacific Offshore Cetaceans	17	227
Pelagic Longline	26	115
Atlantic Offshore Cetaceans*	18	62
Atlantic Trawl Gear*	34	100
False Killer Whale*	27	59

\*Not analyzed for ecological evaluation

### **3.1.2 A Social and Ecological Evaluation of Marine Mammal Take Reduction Planning**

Without monitoring data on the environmental resource targeted for management, it is nearly impossible to verify that conservation efforts implemented from stakeholder agreements result in actual environmental change. Moreover, as discussed above, there are limitations to extrapolating participant perceptions of satisfaction and success to policy outcomes and ecological success (Coglianese, 2003; Leach et al., 2002). To better understand the effectiveness of multi-stakeholder, environmental conservation programs and the relationship between participant views of ecological outcomes and actual outcomes, researchers should examine stakeholder

opinions in the broader context of policy implementation and actual outcomes (Coglianese, 2003; Leach et al., 2002).

Birkhoff and Lowry (2003) list the following four purposes of evaluating multi-party, environmental conflict resolution processes: 1) assess effectiveness in relation to program goals, 2) contribute to political or social theory, 3) improve negotiation processes, and 4) maintain accountability. This chapter speaks to Birkhoff and Lowry's first purpose by examining ecological and sociological data simultaneously to evaluate Take Reduction Plans in relation to statutory goals. By quantitatively and qualitatively examining the actual ecological outcomes of marine mammal Take Reduction Plans (Chapter 1) in relation to the ecological outcomes perceived by Take Reduction Team members, as described in Chapter 2, this study will characterize the relationship between perceived and actual ecological success, thereby addressing the shortcomings of using participant perceptions as a proxy for actual success.

## **3.2 Methods**

### **3.2.1 Quantitative comparison**

#### **3.2.1.1 Actual ecological success**

Using data from Marine Mammal Stock Assessment Reports, I ranked the ecological outcomes of five Take Reduction Plans (Atlantic Large Whale, Bottlenose Dolphin, Harbor Porpoise, Pacific Offshore Cetaceans, and Pelagic Longline) by

comparing marine mammal bycatch to the MMPA short- and long-term goals of PBR and ZMRG. Chapter 1 provides a more detailed description of these methods. Below I review the calculations for the two metrics used to evaluate ecological success.

Metric 1 is a simple categorical measure of whether or not bycatch was reduced and maintained below PBR or ZMRG as follows:

0 = Bycatch >PBR

1 = Bycatch <PBR and >ZMRG, and remained there through 2011

2 = Bycatch <ZMRG, and remained there through 2011

Stocks where bycatch fluctuated above and below ZMRG were assigned a score of 1, while stocks that fluctuated above and below PBR were assigned a 0. Ranks of all stocks managed under a plan were averaged to determine a mean rank. I excluded stocks that were below ZMRG prior to implementing a plan.

Metric 2 was the mean of the annual difference in bycatch from PBR divided by PBR itself.

$$\text{Metric 2} = \text{mean}[(\text{PBR}-\text{Bycatch})/\text{PBR}]$$

such that:      1 implies No bycatch

0.90–0.99 implies  $\leq$ ZMRG (because ZMRG = 10% of PBR)

0.00–0.89 implies >ZMRG and  $\leq$ PBR

<0.00 implies >PBR

Ranks of all stocks managed under a single plan were averaged to determine mean rank and, as above, I excluded stocks that were below ZMRG prior to implementation of a plan.

To determine the significance of independent predictors or covariates, I conducted a multiple regression analysis of the ecological ranks on the independent variables of PBR, U.S. geographic region, and Take Reduction Team size and age using Mplus (Muthén and Muthén, 1998-2010).

#### **3.2.1.2 Perceived ecological success**

I administered a web (N=219) and traditional mail survey (N=25) to all Take Reduction Team participants (past and present) to capture their views of the ecological outcomes of the marine mammal Take Reduction Plans. Chapter 2 describes in detail the methods used to create and administer the survey. Two questions examined participant views of the ecological outcomes. One asked about the effects of Take Reduction Plans on marine mammal bycatch while the other asked about effects on abundance of marine mammal stocks. By using frequency tables of both questions combined, I compared survey responses across teams.

### 3.2.1.3 Structural Equation Models (SEMs)

I created three Structural Equation Models (SEMs) with latent variables to analyze the survey data using MPlus, v 6.1 (Muthén and Muthén 1998-2010). Chapter 2 and Appendix A provide detailed descriptions of Structural Equation Models in general and the models I created. To analyze the ecological data with the survey data, I used Structural Equation Model #2 described in Chapter 2, which illustrates stakeholder opinions about the outcomes of Take Reduction Plans (Perceived Ecological Success). I incorporated the ranks from the ecological evaluation (Metrics 1 and 2) as independent predictors of the latent variable Perceived Ecological Success (PCD ECO). I ran the model first using a database with all of the Take Reduction Teams and then a model that included data from only those five teams on which I was able to conduct the ecological analyses. Model fit was best with the smaller database. Therefore, I will discuss the results from the database with only those teams analyzed in the ecological evaluation.

#### 3.2.1.3.1 *Latent variable model*

The best fitting model included one latent variable representing perceived ecological success (PCD ECO), which was regressed on covariate predictors that included the Take Reduction Team identity, team size and age, stakeholder affiliation, U.S. geographic region, and the causal indicators Metrics 1 and 2 (from the ecological evaluation). To improve model fit, I retained only the significant covariates and causal

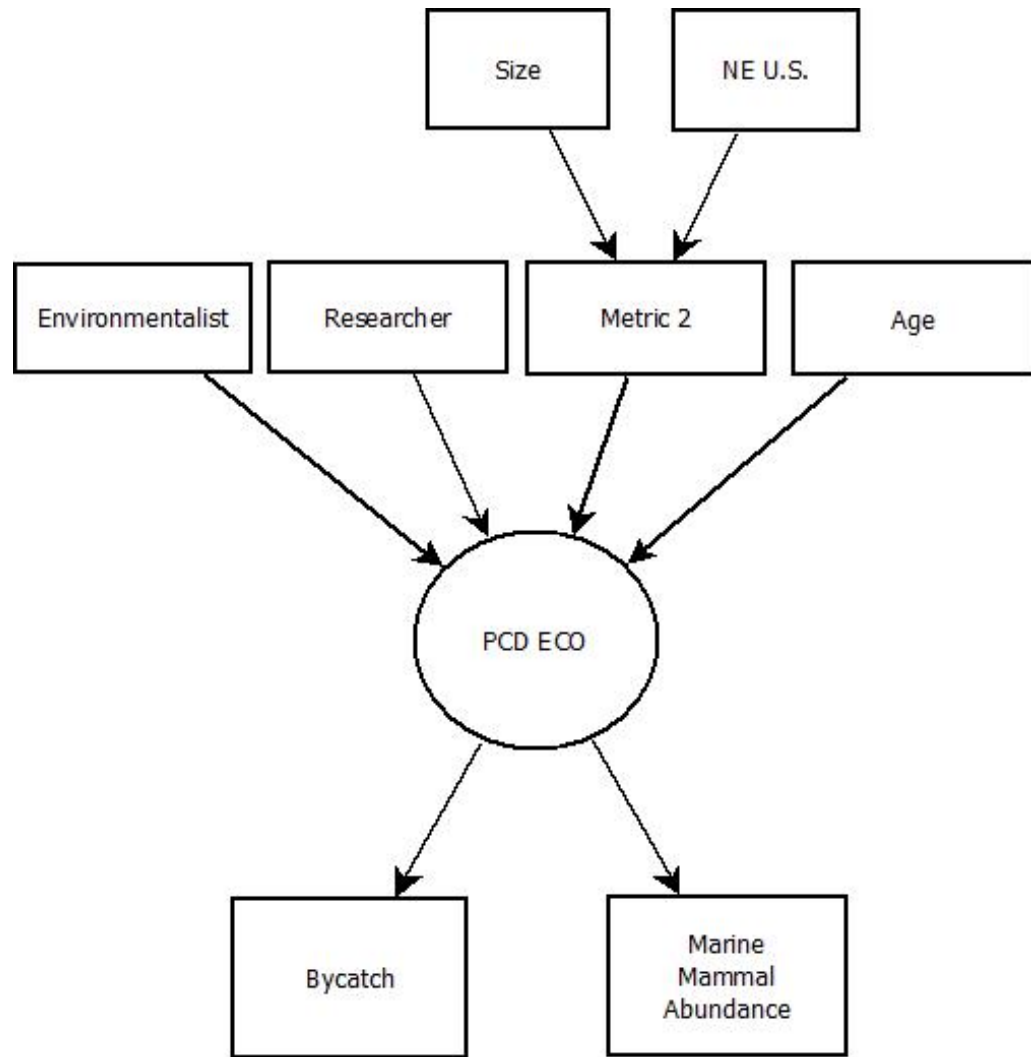
indicators, which included Metric 2 (from the ecological evaluation), team age, researchers, and environmentalists (Table 19). Significant predictor variables of Metric 2 that were identified in the regression analysis of the ecological data included the northeastern U.S. and team size (Table 3 – Chapter 1). These were included in the model as indirect predictors of Perceived Ecological Success (PCD ECO, Figure 7).

**Table 19: Regression coefficients of the independent predictors and the squared multiple correlation coefficient ( $r^2$ ) of the latent variable Perceived Ecological Success (PCD ECO).**

<b>Latent Variable</b>	<b><math>r^2</math></b>	<b>Predictor</b>	<b>Regression Coefficient</b>	<b>Two-tailed p-value</b>
PCD ECO	0.29	Metric 2	1.20	0.001
		Age	0.02	0.000
		Researchers	-1.08	0.001
		Environmentalism	-1.86	0.003

#### *3.2.1.3.2 Measurement Model*

PCD ECO was measured by two 7-point Likert scale questions about effects of the Take Reduction Team process on marine mammal bycatch and marine mammal abundance (“made much worse” to “made much better,” see Appendix B). I chose BYCATCH as the scaling indicator (Figure 7).



**Figure 7: Structural Equation Model fusing Perceived Ecological Success (PCD ECO) as the latent variable (circle) and actual ecological success a causal indicator of PCD ECO (Metric 2). It depicts team size and the northeastern U.S. as predictors of Metric 2. Measurement indicators included Take Reduction Plan effects on marine mammal bycatch and abundance. Error terms were omitted for clarity.**

### **3.2.2 Qualitative Comparison**

I ranked the perceived ecological success of each Take Reduction Plan based on the response frequencies to the questions about the effects of the Take Reduction Plans on marine mammal bycatch and abundance. For both questions combined, I calculated the average frequency of the combined responses of “made slightly better,” “made somewhat better,” and “made much better” and ranked each team relative to each other based on these average frequencies. I then compared those ranks to Metrics 1 and 2 from the ecological analysis to identify similarities and discrepancies.

### **3.2.3 Interviews**

Semi-structured interviews of 22 Take Reduction Team members and open-ended comments of the survey helped to clarify survey responses and various stakeholder opinions about the effectiveness of marine mammal Take Reduction Plans. An interview guide was informed by the survey and participant observations conducted during 14 Take Reduction Team meetings and webinars. I used the guide to direct the conversation and insure that I covered all topics consistently across interview participants. Details about the interview methods are described in Chapter 2.



### **3.3 Results**

#### **3.3.1 Ecological Analyses**

The ecological effectiveness of marine mammal Take Reduction Plans varied considerably among teams (Table 20). Relative rankings among the plans also differed slightly between Metrics 1 and 2 (Table 20). Metric 1 ranked the Bottlenose Dolphin and Pacific Offshore Cetaceans plans as the two highest (most effective ecologically). Although Metric 2 ranked the Bottlenose Dolphin plan (minimum bycatch estimate<sup>1</sup>) as ecologically best, three plans were tied for the second highest - Bottlenose Dolphin (maximum bycatch estimate<sup>1</sup>), Pacific Offshore Cetaceans, and Pelagic Longline. Both metrics ranked the Atlantic Large Whale and Harbor Porpoise plans as least successful ecologically, but their rank orders were reversed (Table 20).

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<sup>1</sup> The Stock Assessment Reports for the bottlenose dolphin stocks described bycatch levels in terms of minimum and maximum potential values due to uncertainty regarding the stock identity of dolphins taken as bycatch in gillnet fisheries. Thus, I conducted separate rankings with these minimum and maximum values.

**Table 20: Results of the ecological rankings for Metrics 1 and 2 and Perceived Ecological Success (from the frequency of survey responses of made slightly better to made much better – see Table 8). Bycatch of bottlenose dolphins was split into minimum and maximum estimates, but perceived success was for the entire Bottlenose Dolphin Take Reduction Plan.**

Take Reduction Team	Metric #1	Metric #2	PCD ECO
Bottlenose Dolphin - min	1.75	0.89	84.4%
Bottlenose Dolphin – max	1.50	0.51	
Pacific Offshore Cetaceans	1.20	0.51	90.0%
Pelagic Longline	1.00	0.51	58.0%
Atlantic Large Whale	0.33	-0.50	69.0%
Harbor Porpoise	0.00	0.13	84.3%

The regression coefficients of the predictors for actual ecological success (Metrics 1 and 2) were negative (Table 21). This suggests that large teams and those in the northeastern U.S. were less successful at reducing bycatch than plans created by smaller teams and in other geographic regions. The covariate predictors accounted for a very large proportion (87%-90%) of the variance in Metrics 1 and 2 (Table 21).

**Table 21: Regression coefficients for the covariate predictors of Metrics 1 and 2 using the database of the social and ecological data combined.**

Dependent Variable	Independent			
	Predictor	Estimate	P-value	R <sup>2</sup>
Metric 1	NE U.S.	-2.18	0.000	0.87
Metric 2	Size	-0.02	0.000	
	NE U.S.	-1.00	0.000	

### 3.3.2 Survey Results

The response rate for the web survey was 60%, while that of the mail survey was much lower at only 36% for a combined response rate of 59%. The number of responses by team also varied and mirrored team size; the Atlantic Large Whale team had the most and the Pacific Offshore Cetaceans had the fewest (Table 22). Most respondents were fairly experienced with the take reduction planning process. Almost half were members of more than one team and two-thirds participated in four or more meetings or webinars per team.

**Table 22: Number of survey respondents per Take Reduction Team, number and percentage of respondents of more than one team, and total number of responses.**

Take Reduction Team	No. Respondents	No. respondents on > 1 team	% respondents on >1 team	Total No. Responses (records in database)
Atlantic Large Whale	65	43	66%	65
Bottlenose Dolphin	53	37	70%	53
Harbor Porpoise	54	48	89%	54
Pelagic Longline	29	21	72%	29
Pacific Offshore Cetaceans	11	4	36%	11
<b>TOTAL</b>	<b>212</b>			<b>212</b>

The majority (77%) of the members of the five teams used in the ecological analyses believed that bycatch and abundance were at least slightly better as a result of take reduction planning, and nearly half (49%) thought they were somewhat or much

better (Table 23). Members of the Pacific Offshore Cetaceans Team reported the highest perceived ecological success (90%), while members of the Pelagic Longline team had the lowest average ratings (58%).

**Table 23: Frequency distribution table of survey responses to two questions combined about Perceived Ecological Success. ALW=Atlantic Large Whale, BD=Bottlenose Dolphin, POC=Pacific Offshore Cetaceans, and PL=Pelagic Longline.**

<b>Response</b>	<b>ALW</b>	<b>BD</b>	<b>HP</b>	<b>POC</b>	<b>PL</b>	<b>Total</b>
<b>Made much worse</b>	0.9%	0.0%	0.0%	0.0%	0.0%	0.3%
<b>Made somewhat worse</b>	1.8%	0.0%	1.1%	0.0%	0.0%	0.9%
<b>Made slightly worse</b>	0.9%	0.0%	1.1%	0.0%	0.0%	0.6%
<b>No effect</b>	27.0%	15.6%	13.5%	10.0%	41.9%	21.8%
<b>Made slightly better</b>	29.7%	29.9%	23.6%	5.0%	34.9%	27.4%
<b>Made somewhat better</b>	27.9%	42.9%	39.3%	50.0%	20.9%	34.7%
<b>Made much better</b>	11.7%	11.7%	21.3%	35.0%	2.3%	14.4%
<b>Slightly + somewhat + much better</b>	<b>69.4%</b>	<b>84.4%</b>	<b>84.3%</b>	<b>90.0%</b>	<b>58.1%</b>	<b>76.5%</b>

### 3.3.3 SEM Results

The best fitting model showed the significant causal indicator of PCD ECO was Metric 2 from the ecological analyses, while significant covariates were team age, researchers, and environmentalists (Figure 7, Table 19). Team age and Metric 2 had positive regression coefficients (Table 19). Members of older teams viewed the Take Reduction Plans as more effective than members of newer teams, and increases in actual ecological success improved the perceived ecological success. Team size and the northeastern U.S. significantly and negatively influenced Metric 2 (Table 21) and

therefore, indirectly affected perceived ecological success (PCD ECO). The other significant, independent predictors (researcher and environmentalist) also had negative regression coefficients (Table 19). Members of these groups believed the Take Reduction plans did not substantially reduce bycatch or increase marine mammal abundance. The independent predictors and causal indicators explained 29% of the variance in the latent variable perceived ecological success (PCD ECO, Table 19).

The factor loadings for both measurement indicators (marine mammal BYCATCH and ABUND) on perceived ecological success (PCD ECO) were significant, with high reliabilities (Table 24). This result indicates that stakeholder opinions about the impact of the Take Reduction Plans on both marine mammal bycatch and stock abundance are good indicators of overall perceived ecological success of the plans. In other words, a change in perceived ecological success would directly affect perceived impacts on both bycatch and abundance. The latent variable, PCD ECO, explains a substantial portion of the variance in both indicators (bycatch and abundance), and the internal consistency of the responses to each question about effects on bycatch and abundance was high. Model fit was excellent as measured by the chi-square difference test, Root Mean Square Error of Approximation, Comparative Fit Index, and Tucker-Lewis Index (Table 25).

**Table 24: Measurement indicators (bycatch and abundance) of perceived ecological success (PCD ECO), factor loadings ( $\lambda$ ), and reliabilities (squared multiple correlation coefficients).**

Measurement Indicator	Factor Loadings ( $\lambda$ )	Reliability ( $r^2$ )
BYCATCH*	1.00	0.998
ABUNDANCE	0.80	0.703

\*scaling indicator ( $\lambda = 1.0$ )

**Table 25: Model fit statistics for the Structural Equation Model of Perceived Ecological Success that incorporates actual ecological success as a predictor.**

$\chi^2$ DIFF test	$\chi^2$ DIFF df	$\chi^2$ DIFF p-value	RMSEA	CFI	TLI
0.142	1	0.7064	0.000	1.000	1.007

### 3.3.4 Qualitative Comparison of Ranks

The ecological analyses ranked the Bottlenose Dolphin and Pacific Offshore Cetaceans Take Reduction Plans as the two most successful and the Atlantic Large Whale and Harbor Porpoise Plans as the two least successful (Table 20). Perceived ecological success was similar to actual ecological success - the Pacific Offshore Cetaceans and Bottlenose Dolphins teams ranked highest and the Atlantic Large Whale ranked as second lowest (Tables 20 and 23). The Harbor Porpoise plan ranked among

the bottom two in the ecological evaluation, but it ranked third highest in perceived ecological success, on par with the Bottlenose Dolphin plan with 84% of respondents indicating bycatch and abundance were at least slightly better as a result of implementing the Take Reduction Plan (Tables 20 and 23). Ecologically, the Pelagic Longline Take Reduction Plan ranked in the middle, but stakeholders ranked it as the least successful among the teams with active Take Reduction Plans (Tables 20 and 23).

### ***3.4 Discussion***

Both perceived and actual success of marine mammal Take Reduction Plans vary considerably across plans. The quantitative and qualitative comparisons of the social and ecological data revealed many similarities between actual and perceived success and established that actual ecological success significantly influenced stakeholder perceptions of success. Regression analyses confirmed that the covariate of team size significantly influenced actual success and indicated that teams dealing with stocks in the northeastern U.S. were less successful than those in other regions. This outcome concurs with the SEM findings in Chapter 2 that teams in the northeastern U.S. also had lower perceived ecological success. The rankings of perceived success of three teams coincided with their ecological rankings (Pacific Offshore Cetaceans, Bottlenose Dolphin, and Atlantic Large Whale). Two teams, the Pelagic Longline and Harbor Porpoise

differed dramatically, however. Stakeholders on the Pelagic Longline team believed it was much less successful than the ecological data indicated and the reverse was true for the Harbor Porpoise team. Members ranked the latter team much higher than what the actual ecological data revealed.

### **3.4.1 Actual Ecological Success**

Team size negatively affected ecological success, meaning that as the number of Take Reduction Team members increased, actual ecological success decreased (Chapter 1). A large number of stakeholder participants reduces the likelihood of reaching consensus and compliance with the negotiated agreement (Holmes and Scoones, 2000; Leach and Sabatier, 2005), and this study shows that the number of negotiating parties also directly affects the actual ecological success of negotiated agreements. For example, the Atlantic Large Whale teams has not been able to reach consensus, so NMFS has been enacting regulations to mitigate bycatch for the affected stocks. This suggests that plans created by the agency, like the Atlantic Large Whale plan, are less effective at reducing bycatch than those that are created by negotiated rulemaking. Furthermore, large teams may only be able to agree on relatively ineffectual measures that are easily agreed-upon that may not be as impactful as more contentious measures (Coglianese, 2003).



Teams dealing with stocks in the northeastern U.S. were less successful than those in other regions. This tracks the SEM results of Chapter 2 – survey responses indicated that the perceived ecological success of teams in the northeast was significantly lower than teams in other regions (see Chapter 2). One reason posited in Chapter 2 for this finding was that the largest team (Atlantic Large Whale) has never achieved consensus and deals with stocks primarily in the northeastern U.S. Stakeholders also proposed that the politics of the northeast contribute to its negative effect on ecological success.

*“I think what gets in the way of being able to resolve those issues more has to do with the lack of any other way to phrase it, politics, than it does our inability to come up with ideas that could reduce the severity of the problems” –*  
Environmentalist

*“I think it’s a mix of the people and the personalities and the culture of the region and the data availability and the nature of the problem. It’s all of the above and they’re intertwined.” –Facilitator*

*“It’s primarily the Northeast region; [it] clearly gives greater weight to the fisheries comments than comments by any other groups and I think that’s just a reflection of the region. I think there’s a regional difference in the way that the agency pays attention to comments from different sides... And in the New England region, I think they look at it from the perspective, well if you follow fishery management restrictions that we have, we’ll cut you lots of slack on any restrictions that would otherwise be too burdensome under the MMPA.” –*  
Federal employee

*“I would say especially in the northeast region, there is a lack of political will at the regional office to push the Coast Guard harder to do enforcement. I think*

*there is a long and acrimonious history of enforcement efforts in that region ..."*  
–Researcher

*"New England has always been highly political. Whenever the [Fisheries Management] Councils would try to put something like that in place, the politicians would step in and put it on hold, convince the powers that be that this shouldn't be done, it didn't need to be done, it would hurt the fishermen."* –State manager

### **3.4.2 Quantitative Comparison - SEM**

This research has demonstrated that Structural Equation Models can successfully merge ecological and social data, in this case by using the ecological outcome as a causal indicator of the latent variable, Perceived Ecological Success. The model with the best fit used ecology Metric 2 as the predictor and incorporated the covariates for Metric 2 (team size and northeastern U.S.) as indirect predictors of perceived ecological success (Figure 7). Actual ecological success directly influenced perceived ecological success. In other words, actual changes in marine mammal bycatch relative to PBR and ZMRG significantly affected stakeholder perceptions of Take Reduction Plan success or failure. One explanation is that at least one-third of all Take Reduction Team meetings focus on empirical data. In addition, between in-person meetings, NMFS convenes teams via webinar to impart new information, often about recent bycatch events. Prior to Take Reduction Team meetings, the agency provides members with dossiers of background materials that include information about marine mammal bycatch, distribution and

abundance estimates, compliance with and enforcement of Take Reduction Plans, results of gear testing experiments, and outputs from working groups. Prior to any discussion about changes to the Take Reduction Plans, the facilitators solicit members for clarifying questions to ensure that everyone at the table has a clear understanding of the relevant data.

Results from Chapter 2 show that as a result of participation in take reduction planning, 85% of members believed they have learned more about marine mammal bycatch and the fisheries that interact with marine mammals. By keeping Take Reduction Team members updated on empirical information and focusing on shared learning, NMFS has reinforced the positive relationship between actual and perceived ecological success.

### **3.4.3 Qualitative Comparison of Ranks**

Qualitatively, metrics of perceived and actual ecological success were nearly identical for three of the five Take Reduction Plans (Pacific Offshore Cetaceans, Bottlenose Dolphin, and Atlantic Large Whale, Table 20). This follows the results of the quantitative comparison that demonstrated that actual ecological success positively affects perceived ecological success. The two outliers included the Pelagic Longline and Harbor Porpoise Plans.

#### **3.4.3.1 Pelagic longline plan**

The perceived success of the Pelagic Longline Take Reduction Plan was much lower (ranked lowest) than its actual ecological success, which ranked it in the middle. The team was established as a result of a lawsuit (N.D. Cal. Apr. 30, 2003). At the time, neither of the marine mammal stocks (Western North Atlantic pilot whales and Risso's dolphins) was strategic, meaning that bycatch was below PBR. Until recently, NMFS had been unable to distinguish which pilot whale species (long-finned or short-finned) was interacting with the longline fishery, so it combined the PBR values for each stock. Pilot whale bycatch has historically been highly variable, but using the combined PBR kept estimates of pilot whale bycatch below PBR. Recently, the agency has determined that the pelagic longline fishery interacts only with short-finned pilot whales. Thus, bycatch is now compared only against PBR for the short-finned species. In 2011, short-finned pilot whale bycatch in pelagic longlines exceeded PBR. Thus, when taking the survey, stakeholders may have been thinking about the change in status of pilot whales - from non-strategic to strategic. The change in bycatch from below PBR to exceeding PBR would signal that the plan is not effective at reducing bycatch.

Second, the empirical information discussed at Take Reduction Team meetings centered almost exclusively on pilot whales. Presentations by NMFS researchers focused on trying to distinguish between the two pilot whale species, stock assessments, and

determining which of the two interact with the pelagic longline fishery. Gear research also focused on pilot whales and independent researchers used pilot whale carcasses to test hook-tissue interactions. Risso's dolphins, which are below ZMRG, are not actively discussed at meetings. I used data from Risso's dolphin Stock Assessment Reports to calculate Metrics 1 and 2, but it is likely that stakeholders were not thinking about Risso's dolphins when answering the survey questions about the effects of the Pelagic Longline Take Reduction Plan on bycatch.

Finally, as discussed in Chapter 2, many respondents believed that the primary requirement of the Pelagic Longline Take Reduction Plan is not enforceable. This belief is supported by the statements of a member of the U.S. Coast Guard during the August 2012 Take Reduction Team meeting (CONCUR, 2012). The survey was administered in 2013, after that particular discussion. The survey did not inquire about plan implementation, but the perceived enforceability of a plan likely affected participant views about its effectiveness.

#### **3.4.3.2 Harbor porpoise plan**

The second discrepancy between actual and perceived success was with the Harbor Porpoise Take Reduction Plan. Annual fluctuations in bycatch since 2001 and political events beginning in 2012 that have affected the ability of the Harbor Porpoise

team to achieve consensus did not appear to influence the survey responses of most members about the plan's ecological success.

Prior to creation of the Harbor Porpoise team, a group of fishermen, researchers, and environmentalists formed the Harbor Porpoise Working Group to address harbor porpoise bycatch in the northeast sink gillnet fishery (RESOLVE, 1996; Smolowitz and Wiley, 1992). The Working Group formally became the Harbor Porpoise Take Reduction Team in 1996. The team achieved consensus and produced the first Harbor Porpoise Take Reduction Plan in December 1998. Among various elements, the plan required fishermen to use acoustic deterrence devices, called pingers on gillnets to warn porpoises of the presence of the nets. Pingers were experimental when the plan was first drafted, so team members also added a stipulation to the plan termed the "Other Special Measures Provision" that allowed NMFS to modify the plan without reconvening the team if the agency verified that pingers or the other plan requirements were ineffective (50 CFR 229.34(d)).

The Harbor Porpoise Team was initially very successful at reducing bycatch below PBR, nearly to ZMRG (Geijer and Read, 2013), but six years later, a lack of compliance with the pinger requirements caused bycatch to exceed PBR once again (Geijer and Read, 2013; Orphanides and Palka, 2012; Palka et al., 2012; Palka et al., 2008). In late 2007, the team reconvened to try and mitigate bycatch to below PBR. The team

agreed to a consensus-based compromise that incentivized pinger compliance by establishing bycatch thresholds for three areas that experienced high bycatch, termed Consequence Closure Areas (CCAs, 50 CFR 229). If average bycatch over a two-year period exceeded the threshold, a seasonal closure would be triggered.

The 2008 plan amendments were not implemented until March 2010 (75 FR 7383). During that time, New England fisheries were reconfigured into fishing cooperatives called Sectors (69 FR 22906, 74 FR 18262, 76 FR 23042). Two Sector Managers and the Executive Director of the Northeast Seafood Coalition (NSC) were added to the Harbor Porpoise team, replacing working fishermen who had resigned ([http://www.greateratlantic.fisheries.noaa.gov/prot\\_res/porptrp/doc/Member%20List%20for%202007%20TRT%20Meeting.pdf](http://www.greateratlantic.fisheries.noaa.gov/prot_res/porptrp/doc/Member%20List%20for%202007%20TRT%20Meeting.pdf)).

In 2010, bycatch exceeded the southern Gulf of Maine Consequence Closure Area threshold by more than double, which meant that the closure scheduled for October-November 2012 was inevitable, even if bycatch in 2011 was zero. In response, the Sector Managers and Northeast Seafood Coalition sent a letter to the NMFS Northeast Regional Office requesting, under the authority of the “Other Special Measures Provision,” that the agency shift the southern Gulf of Maine closure from October-November 2012 to February-March 2013 (Northeast Seafood Coalition, 2012). Several Take Reduction Team members submitted written comments urging NMFS to deny the request (Northeast

Seafood Coalition, 2012). They argued that the Consequence Closure Areas were recommended by consensus and modifying them would both undermine the Harbor Porpoise Take Reduction Team process and future compliance with the Take Reduction regulations.

NMFS denied the request in a letter written in early September 2012 (National Marine Fisheries Service, 2012b). The letter was signed by the newly appointed Northeast Regional Administrator and former mayor of New Bedford, Massachusetts, John Bullard. Three weeks after the initial denial, Mr. Bullard reversed his decision in an announcement at the Northeast Fisheries Management Council meeting, shifting the Gulf of Maine Consequence Closure Area from October-November 2012 to February-March 2013 (Bullard, 2012). As a result of this decision, three people who were members of the original Harbor Porpoise Working Group have resigned and the team has not again achieved consensus (CONCUR, 2013a, b; Read et al., 2012).

The survey for this dissertation was implemented in the midst of the fallout that was triggered by the NMFS reversal of its decision about the shifted Consequence Closures. Based on interviews and conversations with team members, however, I believe that when responding to the survey, many of the Harbor Porpoise team members were thinking in the long-term, over the life of the team. The Harbor Porpoise plan was initially very successful at reducing marine mammal bycatch and coupled with



drastically reduced fishing effort, current bycatch levels are much lower than when the team was first convened in 1996, and have been declining since 2009 (again, resulting from decreased fishing effort, see Chapters 1 and 2). The survey asked if the Harbor Porpoise Plan made bycatch better or worse, rather than if it reduced bycatch to below PBR or ZMRG. Interviews indicated that some members were not thinking about the recent events, but rather about the long-term trend in harbor porpoise bycatch.

*“...just thinking about the numbers in the Harbor Porpoise Plan, we are nowhere near...the number of takes that we had back in whatever, ‘94,’95,’ 96. Whenever those plans started [takes] were way higher than what we have now.”*  
–State Manager

*“We devised a plan that worked. So that was a success.”* –Researcher

*“But with harbor porpoises... the mortality rate’s going down”* –State manager

*“It is a LOT better than since the 90’s but is up and down since about 2001 when it has bounced from ZMRG to over 1,000 animals w/in a couple of years and then back and forth.”* –Environmentalist (written comments from survey)

#### **3.4.4 Caveats**

The data limitations discussed in Chapter 1 affected my analyses in several ways. I was unable to compare participant views of the success of the False Killer Whale team to actual ecological success because the plan was implemented in 2011. Also, I was only able to evaluate 4 of the 18 stocks covered by the Bottlenose Dolphin plan because of

changes to stock delineations, which restricted the amount of data for the analyses.

However, members likely thought about more than those four stocks when answering the survey questions. While participant perceptions track the ecological data in this study, discrepancies between the social and ecological data show that participant perceptions may not always be a valid proxy for actual ecological measures.

Finally, without reliable data on compliance and law enforcement collected methodically and consistently, it was impossible to determine the extent to which the implementation of the Take Reduction Plans in reality actually affected their ecological success. Data from the Harbor Porpoise plan suggest a direct link between compliance with Take Reduction Plan requirements and bycatch (Allen et al., 1999; Orphanides and Palka, 2012; Palka et al., 2012). But this is not surprising; it has been well-established elsewhere that when used properly, pingers are highly successful at reducing marine mammal bycatch (Carretta and Barlow, 2011). The effectiveness of other Take Reduction Plan requirements are unknown, and thus may not reduce bycatch simply because the measures are not effective, regardless of compliance or enforcement. Moreover, the only information about compliance and enforcement for this study comes from the semi-structured interviews, journal articles, and government reports. Regrettably, the survey did not contain any questions about implementation which would have at least provided a sense of how the stakeholders felt about this topic and how it may have

affected perceived ecological success. For effective mitigation strategies like pingers, implementation of the regulations is critical to determining success of the plan.

### **3.5 Conclusions**

This research is the first to examine, in both quantitative and qualitative fashion, the ecological outcomes of regulations generated by negotiated rulemaking simultaneously with stakeholder opinions about those outcomes. Structural Equation Models provided a useful framework to quantitatively relate the two types of data, in which the actual ecological outcomes were used as independent predictors of the perceived outcomes. This analysis indicated that the ecological outcome was a good predictor of perceived outcome. In other words, improvements in marine mammal bycatch enhanced stakeholder opinions about the effectiveness of marine mammal Take Reduction Plans. It is likely that the emphasis that the NMFS places on empirical information and keeping stakeholders informed about bycatch, marine mammal stocks, and fisheries facilitated this relationship. Other independent predictors of perceived ecological outcomes included team age and stakeholder affiliation. Older teams were perceived to be more successful, while researchers and environmentalists had a more negative view of the ecological outcomes (see Chapter 2).

The quantitative analysis also identified two significant independent predictors of actual ecological success – team size and those dealing with stocks in the northeastern U.S., both of which were inversely related to ecological success. As team size increased, actual ecological success decreased. In addition, teams in the northeastern U.S. were less successful than teams in other regions. One reason for this result could be that this region contains the largest team – one that has never reached consensus. Stakeholders also identified regional politics surrounding fishing as a reason for the decreased success of these northeastern teams. The northeastern U.S. also was a significant, negative covariate of perceived ecological success discussed in Chapter 2.

The qualitative analysis was similar to the quantitative analysis in that the social and ecological rankings were the same for three of five Take Reduction Plans (Pacific Offshore Cetaceans, Bottlenose Dolphin, and Atlantic Large Whale). The two plans that differed in actual and perceived outcomes were those created by the Pelagic Longline and Harbor Porpoise teams.

The Pelagic Longline team includes two marine mammal stocks, one of which, Risso's dolphins, has been below ZMRG for several years. Discussions at the Pelagic Longline team meetings focus almost exclusively on fisheries interactions with short-finned and long-finned pilot whales. After recent findings that the pelagic longline fisheries interact with only short-finned pilot whales, bycatch now exceeds PBR (as of

the most recent Stock Assessment Report). Moreover, one regulatory measure was viewed as unenforceable by team members and the U.S. Coast Guard (see Chapter 2), which may have influenced members' views of the plan's ability to reduce bycatch.

The Harbor Porpoise team has a long history of camaraderie and achieving consensus. Before the team was officially established under the MMPA, stakeholders took it upon themselves to meet and generate creative solutions to mitigate harbor porpoise bycatch. Despite recent political events that eroded stakeholder trust and damaged the team's ability to achieve consensus, team members were optimistic about the ecological success of the plan. When responding to the survey, team members likely were thinking of the long-term history of the team and the fact that in the past, the plan was able to substantially reduce harbor porpoise bycatch, almost to ZMRG. Porpoise bycatch has been variable, and is responding more to fishing effort than regulations implemented by the Take Reduction Plan, but it is still lower than it was in the mid-1990s when the team was first established.

It is unknown to what extent plan implementation (i.e., compliance and enforcement) affects both perceived and actual ecological success, but I suspect it is significant. Pinger compliance studies related to implementation of the Harbor Porpoise plan showed that when a measure has proven to be effective, compliance is critical to reducing bycatch. Other bycatch mitigation measures may not be as effective as pingers,

but without reliable compliance and enforcement data, it would be impossible to tease apart whether the measure is (1) ineffective, or (2) effective when implemented, but suffers from a lack of compliance.

Finally, the only reason I was able to conduct this research was because of the long-term monitoring of marine mammal bycatch provided in the Stock Assessment Reports (<http://www.nmfs.noaa.gov/pr/sars/species.htm>). Despite its data flaws and inconsistencies, without the Stock Assessment Reports, there would be no measure of the actual ecological effectiveness of these plans. This underscores the importance of creating and maintaining long-term, ecological monitoring programs.

## **4. Chapter 4: Recommendations**

### ***4.1 Introduction***

The marine mammal take reduction planning process has all of the objective ingredients necessary for effective consensus-based, multi-stakeholder negotiations (Chapter 2). By focusing on empirical information and shared learning, NMFS has decreased hostility among opposing coalitions, improved social capital, and created a group of knowledgeable stakeholders who have devised creative solutions to address marine mammal bycatch. Informed stakeholders also had relatively accurate perceptions of the actual ecological effectiveness of the Take Reduction Plans (Chapter 3). The long timeframes over which the teams have been meeting generally have increased cooperation. The professionally trained, neutral facilitators have produced fair negotiations, in which most individuals felt they had an opportunity to contribute. Participant views of fairness significantly influenced their satisfaction with Take Reduction Plans, which significantly affected their perceptions about the effectiveness of those plans (Chapter 2). The mandate to create a consensus-based output has, for the most part, minimized defections from the negotiations and facilitated stakeholder buy-in.

However, although Take Reduction Teams possess the nominal ingredients required to be effective, their success both from an ecological and social perspective has

varied (Chapters 1 and 2). Large teams and those operating in the northeastern U.S. (Maine to North Carolina) were least successful at reducing bycatch, and this fact was reflected in stakeholder views of the effectiveness of these teams. While participants believed they have had an opportunity to express their views, they have not always felt the agency listened to their views (Chapter 2). Moreover, consensus-based negotiations have not always produced practical or enforceable regulations (Chapters 2 and 3). Implementation of Take Reduction regulations is critical in determining plan success and identifying effective mitigation measures, but because of a lack of consistent monitoring, the degree of success has not been characterized for most teams. Additionally, elements like the “Other Special Measures Provision” in the Harbor Porpoise Take Reduction Plan have undermined the negotiation process by allowing NMFS to alter consensus-based elements without consulting the team or requiring their consent, which has led to hostility, mistrust, and frustration among stakeholders (Chapters 2 and 3).

This chapter proposes recommendations to improve what is generally a successful negotiated rulemaking process. These recommendations were compiled from semi-structured interviews of 22 current and former Take Reduction Team participants, survey responses from 139 individuals, and participant observations of marine mammal



Take Reduction Teams and webinars from 2010-2014. Chapters 1 and 2 provide detailed descriptions of the data collection methods.

## ***4.2 Membership***

### **4.2.1 Limit Team Size**

As mentioned in previous chapters, the number of negotiating parties in an endeavor such as a Take Reduction Team can decrease the likelihood of achieving consensus. Large groups are more likely to form coalitions, which can hinder the ability of facilitators to manage the discussion (Susskind and Crump, 2008). In addition, as the number of participants increases, negotiators often must recalibrate the nature of possible alternatives, and the outcomes they are willing to accept (Susskind and Crump, 2008). In Chapter 3, I found that the size of marine mammal Take Reduction Teams had a significant, negative effect on actual ecological success, meaning that as team size increased, ecological effectiveness decreased. Take Reduction Team participants were confounded by the logistics of participating in discussions with many stakeholders. For example, all members have name cards in front of their seats at the negotiation table. Rather than raise their hands, team members tilt their name cards when they want to say something or ask a question. When several members have their cards tilted at the same time, the discussion can quickly change topics and become hard to follow. If the queue is

long, a member may have his or her card tilted for quite a while and therefore have multiple issues he or she wishes to address by the time he or she is called on to speak.

“Now you've got 17 cards [requesting permission to speak] before anybody gets to talk...” –Environmentalist

“Just the sheer size of the group impeded...input to some extent because there's so many people that want to talk, just because of the size of it, it is counter-productive.” –Fisheries manager

An exception to this general rule is the Bottlenose Dolphin team, which is large, but has received high marks for its ecological and social components. This might be attributed to the use of working groups to resolve specific issues. In a study by Susskind and McMahon (1985), the Environmental Protection Agency conducted successful negotiated rulemakings with more than 25 participants by breaking up the participants into smaller working groups to complete tasks that the larger group could not. Because actual ecological success influences perceived success, one way to improve both perceived and actual success would be to reduce team size. For teams that have trouble negotiating because the logistics of negotiating have become impractical and as a result, preclude consensus, I recommend the agency limit the number of negotiating parties around the table. The Negotiated Rulemaking Act of 1990 (5 U.S.C. 561 et seq.) limits participation to 25 members unless the agency determines more are necessary for a balanced membership (5 U.S.C. 565(b)). One way to maintain representation while

limiting membership could be to employ pyramiding representation where stakeholders are involved indirectly by individuals who represent a larger constituency. For example, one voting environmentalist and alternate could represent all environmental groups and likewise, one voting fisherman and alternate from each fishery could represent all fishermen in that fishery, rather than one from each fishery in each state. Susskind and McMahon (1985) found pyramiding representation was successful in including more stakeholder groups while limiting the number of parties at the negotiation table. One stakeholder suggested that time be set aside for caucusing within each stakeholder coalition so that all members can voice their opinion to their representative. Only one representative, however, would participate in the discussions about options and the consensus vote.

*"Choosing carefully people who are legitimately going to be able to represent the interests of the people, and allow the time as we used to always have, for people to consult with their constituent base. So you know you've got breaks and things like that. You've got not only the caucuses but also people can call and say hey you know Mike I know you're not here but can you agree to X can you live with that? I mean that used to happen more than it does now because people feel like they're at the table they don't have to call anybody. And so I think make them smaller so that the discussions are more personal, people can get to know and trust one another there, and make sure that the people sitting at the table are representative of that interest."* –Environmentalist

#### 4.2.2 Retain Working or Retired Fishermen

As fishermen retire and leave Take Reduction Teams, they are replaced by industry representatives and lobbyists, which has been a concern for many stakeholders (Chapter 2). For example, the Harbor Porpoise team only has one active fisherman and one retired fisherman on a team with 42 members and alternates (<http://www.greateratlantic.fisheries.noaa.gov/protected/porptrp/trt/index.html>).

Fishermen have been critical to the implementation and success of Take Reduction negotiations. They have worked with researchers to create and test new gear, and based on their working knowledge of gear, boats, and oceanic conditions, provided realistic feedback and input regarding the feasibility of proposed measures. As discussed in Chapter 2, buy-in from fishermen is critical to implementation and compliance with proposed take reduction measures. Moreover, other stakeholders have a greater level of trust in fishermen than their industry representatives and lobbyists, and believe that the fishermen are more willing to compromise.

*“I feel that an active fisherman should be at the table, somebody who’s got a lot of self-interest and understanding of where the fishery is going.” –Fisherman*

*“You need to have active fishermen at the table and not fishing representatives, or lobbyists at the table. It’s fine if those lobbyists are there too but we need to have people who use the gear, who are on the water, who could speak to the way*

*the gear is operated, and the way they interact with gear and animals. And if that doesn't happen also I think the process will fall apart."* –Researcher

*"It was much more effective actually to have the fishermen there ...the NGOs tended to trust the fishermen more than they trusted the advocacy people, in terms of representatives."* –Fisheries Manager

*"And it's harder to come to agreement with people like that [industry representatives] because no matter how you know them personally, they don't have that on the water knowledge that an actual fisherman has and frankly they are much more willing I think to stand their ground ... because they don't know what actually is feasible for the industry to do because they're not on the water"* –Environmentalist

Two different stakeholders also told a story of a fisherman contradicting a lobbyist at a meeting. This increased the mistrust of industry representatives by other stakeholder groups.

*"I remember once one of the industry guys had told their lawyer-type rep ... to just shut the hell up because he actually did want to have this discussion. He did actually want to solve something ... or at least talk about something, as opposed to just saying nothing, we'll figure this out later when we talk to Congress."* – Researcher

*"I've had some embarrassing situations in the past, for example the Bottlenose Dolphin team we had some real fishermen and we also had a couple of industry reps. And they didn't agree. Like the industry rep would say no we can't do that at the same time the real fisherman is going yeah I can do that. And they're looking at each other like huh?"* –Environmentalist

### **4.3 Social Capital**

#### **4.3.1 When Making Consensus-Based Decisions or Amending Plans, Hold Meetings In-Person, Encourage Time for Socializing, and Hold More Meetings within a Shorter Time Period**

Federal budget cuts have forced agencies to look for ways to streamline programs and reduce costs. In-person Take Reduction Team meetings can be very costly to convene. To facilitate communication in a more cost-effective manner, NMFS has conducted Take Reduction Team meetings via webinar. While these can be an economical means of updating members, but they are not an adequate substitute for in-person meetings, especially when major amendments or consensus-based decisions are required. The webinars do not allow participants to foster relationships outside of the meeting, which is critical for building trust and social capital among people with opposing viewpoints.

*"I think it is honestly better for teams when we are forced to meet someplace a little bit out of the way so people have to get to know each other outside of the team meeting, meaning if you meet in the middle of Boston, people go to 12 different restaurants and nobody sits down and has a beer together, and those kinds of things foster collaboration better when you can be sociable with someone. ...So I think having meetings in places that foster people staying together as opposed to scattering is useful for group dynamics." –Environmentalist*

Webinars also do not allow participants to read body language and often, it is difficult to know who is speaking. Technical difficulties such as poor cell phone

connections and feedback can make it challenging for members to hear the discussion, and it is easier for members to be distracted and tune-out of webinars. Repeated, face-to-face interactions increase the likelihood of cooperation, creating contingent agreements, and improving outcomes (Langbein and Kerwin, 2000; Ostrom, 1998, 2011)

*"It's difficult for all of us to be doing this in a bubble or in a dark room essentially, where we can't see each other, interact with each other. You can't see if someone's in the queue." –State manager*

*"The other thing I would think now in particular that is critical is that the teams need to meet in person. The webinar approach will kill the Take Reduction process. If the team is not able to meet in person and negotiate in person, the process won't work. So I think that the teams need to meet in person and I think we're in danger of having the process kind of disintegrate." –Researcher*

*"I would say don't do any sort of over the phone type process. The last time I felt very shut out. Whoever ran the call was only listening to one or two individuals. That's a lot harder to do when you're face-to-face. So I think face-to-face meetings are much more important." –Fisheries manager*

One cost saving measure suggested by an interview subject is to have in-person meetings at predetermined schedules – certain teams meet certain years and other teams meet in the off years (provided nothing urgent has occurred). This could spread out meetings for individuals who serve on multiple teams, and could also allow NMFS scientists who serve as technical support to focus on preparing data for one team at a time (see 4.5.3 below).

*“I think that [they] might want to have some kind of set schedule, like in these odd years, [they’ll] deal with these three teams and have meetings ...and then in the off-years [they] will have meetings of these other teams... So I would like to see [NMFS] be a little more strategic about how and when [they] hold meetings and then the resulting rulemakings that come out of that process.” –Federal employee*

Finally, participants often are unable to reach consensus-based agreements in the standard 3-day timeframe of in-person meetings. Although it is challenging to schedule these meetings and maximize attendance, to facilitate consensus, I support the recommendation of an interview subject that NMFS hold more than one meeting within a 6-9 month period. This would allow time for the agency to update members on new information, answer clarifying questions by the members, and have substantive discussions of possible plan amendments.

*“I think that with a little more time...that we could have actually gotten all the way to consensus.” –Facilitator*

*“I think when you’re looking at negotiations you want to have more meetings in a shorter timeframe and then build off each meeting and finally come to agreement. One of these meetings is generally not enough to come to an agreement when you’re talking about substantive amendments. Sticking with the same timeframe within six months or something, two or three meetings within six months and then bang out an agreement and then [NMFS] can go forth with the rulemaking. But I think the effectiveness suffers. I think implementation suffers. The stocks suffer if it takes two years to get something out of the team and then it takes [NMFS] two years to do rulemaking.” –Federal employee*



### **4.3.2 Continue to Focus on Empirical Information and Shared-Learning**

This research has highlighted the benefits of incorporating shared learning and focusing the negotiations on empirical information. As discussed in Chapter 2, shared learning decreases hostility among members with opposing viewpoints, facilitates creative problem-solving and searching for common values, builds trust among participants and between participants and the agency, and increases social capital (Beierle and Cayford, 2002; Dietz and Stern, 2008; Dukes, 2005; Gray et al., 2012; Innes and Booher, 2004). NMFS should continue to keep members informed about changes to marine mammal stocks, bycatch, and abundance estimates, as well as about fishing effort, mitigation, compliance, and law enforcement. While the webinars may not be a good tool for consensus-based negotiation, they have proven useful for keeping members current. In addition, the pre-meeting background materials help to focus meeting discussions and allow members time to formulate clarifying questions. The agency should continue to be very responsive to stakeholder questions during meetings. This engenders trust and shows the agency's commitment to the process.

### **4.3.3 Strive for Consistent Stock Assessment, Abundance, and Observer Data Collection**

As discussed in previous chapters, stock assessment and abundance data vary in precision, age, and amount. Survey methods and tracklines (predetermined path or

routes followed by ship or aircraft during the survey) may vary from one year to the next, depending on funding sources and availability. Moreover, only half of all fisheries covered by marine mammal Take Reduction Teams have observer coverage and the percentage of observed vessels varies by fleet, fishery, and region (NMFS, 2012). Take Reduction Team negotiations are centered around data collected from surveys and observers. Imprecise bycatch and abundance estimates lead to lower PBR calculations and uncertain stock delineations can result in multiple reconfigurations of those stocks. A lower PBR can limit the negotiating options (see 4.4.2). Uncertainty regarding the boundaries of stocks can decrease stakeholder buy-in and limit the ability to evaluate the effectiveness of plan implementation. In turn, this can lead to frustration and mistrust among Take Reduction Team members.

*"I think observer coverage is really key for those fisheries that can be observed. Information is always going to get you farther. If you know where the bycatch is occurring and you know why the bycatch is occurring, you can solve the problem. If you don't have the data to support rulemaking, then it's just guessing, and so I think that you've got to continue your observer coverage. You've got to make sure that it is representative of the fishery, so everybody bears the burden and everybody gets monitored and none of this kind of voluntary compliance with the observer requirements. So it's got to be representative, and it's got to be at a level high enough that you have some confidence around it. But you also have to get information back to the fishermen, constantly, about what's working and what isn't." –Federal employee*

*"Information, information, information, data, biological estimates, the assessment process, surveys. I believe that we lose a lot from the precautionary*

*principle applied just to the abundance estimate.” –Fishing industry representative*

*“I think we need to have better stock assessment data, more regular stock assessments. But we all realize the chances of that are slim.” –Federal employee*

*“Where we’re hurting is information. The information level that the Take Reduction Teams are given to work with is pretty paltry, pretty sparse. And so you’re left with trying to craft rules based on really minimal observations” – Fisheries manager*

*“I think the one thing that’s frustrated all of us is that there’s a lack of information in a lot of ways. And it would make it so much easier on the part of all the participants if we had less uncertainty about things. And the only way you get less uncertainty is to have more data. To get more data you have to have more money and we don’t have more money.” –Researcher*

#### **4.3.4 When Training New Fishermen, Include Experienced Fishermen to Assist with Conveying Information in a User-Friendly Manner**

Because of the large of amount of information that members must assimilate, new members are on a steep learning curve. It can be especially challenging for fishermen, who are not familiar with the terminology and statistics.

*“I mean it was an adequate representation of what was involved in determining PBR and all the factors associated with it, but nobody understood it, I mean, it was all statistics. These fishermen weren’t versed in statistics. They didn’t understand what 20th percentile [of the] log-normal distribution meant, and neither did I. But, so we were given all this information, but it was like, well, what does that mean?... You’re introducing fishermen into a world that they’re not well-suited to deal with in terms of the bureaucracy, the noise, this huge agency, NMFS” –Fisherman*

To get everyone up to speed, NMFS conducts introductory training sessions for new members. When training new fishermen, I propose the agency include an experienced fishermen in the training to help explain some of the terminology and concepts in terms more easily understood by the fishermen. One interview subject suggested the agency explain MMPA requirements and data using layman's terms.

*"I think other information should be... reduced to the layman's terms for the fishermen ...sometimes ... you get lost when the participant says good morning.... I've seen fishermen in these boats, a million dollar boat that's got a half a million dollars' worth of electronics in front of them, and they can run it better than any person I've ever seen. That means that person can learn, but you've got to give him a chance to understand it. ...we need to get them to talk at a lower key as far as more layman's terms. I mean it's hard to do it when you're extrapolating graphs and all this stuff... it's just they need to talk down to earth...instead of talking like a PhD, talk like a high school graduate."* —  
Fisherman

#### **4.3.5 Improve Data Collection and Monitoring of Law Enforcement and Compliance and Communicate Findings to the Stakeholders**

Determining the effectiveness of Take Reduction Regulations requires both testing of experimental gear and monitoring of compliance and law enforcement efforts. Many regulations restrict fishing effort, which preclude experimental testing because one cannot experimentally test the difference in bycatch within a closed area before and after the closure unless the closed area is closely monitored to guarantee that no fishing is occurring. This leaves compliance and enforcement as the tools to ensure positive

outcomes. As discussed in Chapter 3, without monitoring of compliance and enforcement, it is impossible to distinguish between an ineffective regulation, and an effective regulation that is not being implemented properly through lack of compliance or enforcement.

Therefore, I recommend the Office of Protected Resources work closely with the fisheries observer program and law enforcement agencies to create a robust and reliable program to monitor compliance with and enforcement of marine mammal take reduction regulations. A centralized database that is shared among the programs would facilitate analyses by NMFS scientists. I recommend the database include, at a minimum, location (latitude and longitude), vessel ID, gear type, target species, fishing effort, compliance and if not in compliance, the nature of the violation, if a take of a marine mammal occurred, and a description of the take. Members of the observer program, Office of Protected Resources, appropriate Science Center researchers, and law enforcement agencies ought to have access to this database and enter the information as close to real time as is feasible. For practical reasons, I believe only one of these entities should be responsible for the database quality assurance/quality control (QA/QC). To facilitate information exchange, I recommend NMFS conduct the QA/QC every six months and communicate compliance rates and takes to Take Reduction Team members

after the biannual QA/QC. Close coordination with law enforcement agencies at the highest level is critical to achieve consistency among regions (see 4.5.3 below).

*“But overall, I have to say that and this came out in the GAO report, there’s just not the enforcement. There’s not even necessarily always a follow-up.” – Environmentalist*

*“They didn’t have enough observer coverage so it was very hard to make any statements about compliance based only on the observer coverage. And I don’t believe that enforcement zeroed in on the requirements of the Take Reduction Team as much as they did perhaps other fishery management regulations... I think that you have to have some feedback mechanism to the fishermen, both from the monitoring and then communicating what the results are back to the fishermen saying this is the level of compliance, and this is how it’s affecting the bycatch.” –Federal employee*

*“I think anybody who’s been through this has been frustrated with enforcement and its impact on compliance, and results...follow-through and consistency from the final rule in the plan is really, that’s really the most important. That’s really what yields almost immediate results.” –Fishing industry representative*

*“So communication is key and I think communication is probably one of the least expensive and most effective ways of keeping due diligence on fisheries after you implement a plan.” –Federal employee*

## **4.4 Fairness**

### **4.4.1 Continue to Use Professionally Trained, Neutral Facilitators**

The survey results indicated that regardless of stakeholder or Take Reduction Team affiliation, nearly all respondents believed the process is fair (Chapter 2). This is, in large part, a result of using skilled, professionally trained, neutral facilitators. In addition to ensuring fairness, the facilitators help establish ground rules, keep the

discussion on track, summarize points of agreement, encourage shared learning, and provide detailed summaries of the negotiations (Harter, 1982; Sabatier, 1988; Susskind and McMahon, 1985; Weible et al., 2009). I recommend the agency continue to use highly trained and skilled, neutral facilitators. This is money well-spent. Stakeholders were universally supportive of the facilitators.

*"I think that they helped tremendously in keeping the process moving in a direction and not getting hung-up whenever it did breakdown and you get emotional about some particular issue. That was...probably the most important aspect of the process, to me, was the fact that there were professionals mediating it."* –Fisherman

*"I think the moderators have been very good in recognizing people and letting them speak...you have a chance to raise your concerns."* –Federal employee

*"I think maintaining the high quality of the facilitators will help stakeholders to get to a place where they can agree is important. So it's not necessarily a place where we can improve it but it's a place where we should be vigilant about not letting the quality of the process to slide."* –Researcher

*"The facilitation definitely helped. A neutral facilitator who's trying to work out things ... makes a big difference"* –Fisheries manager

*"The effectiveness of the, of a meeting is very much dependent upon the facilitators"* –State manager

*"And skilled facilitators cannot be underestimated... It makes such a difference. It really does."* –Environmentalist

#### **4.4.2 When PBR of Endangered Species is Extremely Low (less than five), Manage Teams Under the Endangered Species Act**

Stakeholders disagreed about the appropriateness of the precautionary nature of PBR. However, they agreed on the need for requiring a bycatch target and on the difficulty of trying to negotiate when PBR is very low. Negotiating parties require a range of options to make the possibility compromise feasible (Susskind and McMahon, 1985). When PBR is near zero, however, options are limited and there is no room for negotiation. The only way to ensure zero bycatch would be to remove all gear and close the fisheries. Therefore, fishermen feel a greater threat to their livelihoods when PBR is extremely low. Environmentalists, on the other hand, believe that a low PBR or ZMRG provide a target toward which the teams can strive to achieve.

*"Success would be getting it to zero. Do I think it's achievable to get to zero? Heck no. That ain't gonna happen."* –Fisherman

*"...does it make sense to structure a negotiation where you have so little potential zone of agreement? Negotiation theory would say no. You want to figure out how to add value and make the potential zone of agreement bigger. You know at some level, it is a little bit of a one-dimensional problem. We're not really talking about trade-offs between fishing communities and marine mammals or catch in marine mammals, it's about the marine mammals. It's a big challenge."* –Facilitator

*"My personal opinion is that when you have such low PBRs that it doesn't make sense to have that be the focus of the Take Reduction Team because there is no room to negotiate. So I don't think that Section 118 was ever envisioned to address ESA-listed species with extremely low PBRs."* –Federal employee



*"As long as ZMRG is there whether you enforce or not, it serves as a forcing mechanism. And you may not be able to get down to four dolphins coast-wide or whatever but as long as it's there we can keep pushing fisheries toward it so that things are truly accidental and not a wanton disregard." –Environmentalist*

*"You might get 100% compliance, but you're not going to get zero PBR... It's a much more difficult process when you have those tight restraints on what you can actually get away with... Finding consensus when you're up against zero PBR is never going to be easy." –Fisherman*

*"When you're trying to reduce 1,000 to 100, ... you have a lot more options. When you're trying to reduce the 3 to 0, you don't have any options... For endangered species like north Atlantic right whales, [PBR is] probably not the best way to regulate the fishery." –Federal employee*

*"...the ultimate deal is we are not going to get to total zero PBR. We're not. As long as we have gear in the water, there's going to be the chance that it's going to happen." –Fisherman*

In support of a suggestion made by a few stakeholders, I recommend that when PBR is extremely low (e.g., less than five) and the stocks are endangered, the agency not convene a Take Reduction Team. Rather, bycatch should be addressed under the Endangered Species Act through implementation of rules or Recovery Plans. If recovery measures are proven effective and PBR increases, the agency could then convene a Take Reduction Team.

*"I think, my personal opinion, is that with the ESA-listed species that you need to take more drastic measures up-front than you might need to do while awaiting the time to negotiate an agreement with all affected stakeholders and whatnot." –Federal employee*

#### **4.4.2.2 Disband the Atlantic Large Whale Take Reduction Team – mitigate bycatch under the Endangered Species Act**

*"I just noticed that's the team where we have the strongest laws, we actually have the Endangered Species Act on our side here. And we're doing less than we are doing with harbor porpoises for God's sake. It just seems bizarre."* – Researcher

*"I think in those instances where you have something like the Large Whale team that's been in existence for 15, close to 20 years now, where they have yet to come anywhere close to meeting their obligations, what they were supposed to accomplish, there needs to be some mechanism other than the teams, to address the issue...that the team will be disbanded and replaced with something like a Recovery Team, maybe a team of scientists who will come up with recommendations for developing a new Take Reduction Plan."* –Federal employee

*"...large whales should not be managed under the MMPA Take Reduction process. They should be managed under ESA. They are listed species...if we've learned anything in the Take Reduction process is that it does not work for large whales...I don't think we should be managing under the MMPA with right whales. We should be managing under the ESA."* –Researcher

The Atlantic Large Whale Take Reduction Team has been fighting an uphill battle from the beginning. First, PBR is extremely low, especially for north Atlantic right whales, which is often zero or less than one. As described above, this leaves no room for negotiation. Even one take will exceed PBR.

*"The one that comes to my mind as being perhaps not as fair to the resource was the large whale TRT. But I think that that was partly because you had a situation that was not conducive to a Take Reduction Team process."* –Federal employee

*"When you talk about zero PBR, it changes entirely the framework. You're almost afraid to put anything in the water because you might be the guy who puts everybody out of business. You can't operate that way."* –Fisherman

*"We haven't achieved PBR certainly ZMRG at all in the large whales [in] forever, and we have not done what's required by the law to get there...It's [PBR's] almost immeasurable when you talk about 1. If you have 1, that's an accident but we know...that right whales and lobster gear are not accidents. It's just not an accident. We've proven that over a decade now. It happens regularly. It has no teeth. You have to put the teeth into it to make it work."* –Researcher

*"And I would argue that's one of the reasons that the large whale team has been unsuccessful is that because the ... reference point is unattainable, so you are in this weird limbo because nobody thinks you [can] get below a PBR that low..."* –Researcher

Secondly, the team has never reached consensus, defaulting to the agency to create Take Reduction regulations. As described in Chapters 2 and 3, these regulations have been neither effective, nor perceived as effective.

*"The large whale plan was a complete and utter disaster. You had each side bringing their plan forward and in some cases, the industry doing a not great, but not horrible proposal...And the agency, rather than going back and looking at some of the plans or the areas of consensus, drafted something that was completely ludicrous. And I think that already started to dig the ditch that that team has never gotten out of"* –Environmentalist

*"But when you have such different dynamics around what's causing the bycatch especially with each of those gear types, it's a waste of time really to bring those groups together and try to solve it as a group because everyone is just trying to figure out how to position themselves to get the least amount of regulations associated with their group and blame it all on the other group, that they are the ones that are causing all the bycatch and they are the ones that should carry the brunt of the regulations."* –Federal employee

*"And even in the stock assessment reports, the agency cites published scientific literature showing that what they've done hasn't worked, and yet getting anything to change is difficult." –Environmentalist*

The lack of consensus has caused stakeholders to resort to the best alternatives or defect from the negotiations – environmentalists have sued the agency and fishermen have lobbied their legislators. This reinforces resentment and erodes trust among the stakeholders and between the stakeholders and the agency.

*"If they're threatening court action, everybody has to worry because courts can put us out of business. It shouldn't be part of the equation but I understand their frustration because they feel fishermen are not giving their all and if they took that threat away they'd be more willing to give their all. It's sort of a catch 22 you know what I mean?" –Fisherman*

*"...because we've sued not infrequently, and in that case what happens sometimes is that they'll [NMFS will] go with the industry knowing we're going to sue them and then they can say 'well guys we tried to do what we could, but those damned enviros. They just keep suing us.' And I think they count on it in some cases that we're going to sue them and that they're going to have to back off a little bit and that way their ass is covered with the industry and the politicians because they tried and we enviros just interfered with that." –Environmentalist*

*"They recognize they can go to Congress, or they can reach a different result outside of the TRT, which has made a couple of them [TRTs] almost completely ineffective...I don't think we've altered fisheries to the point that they are completely going out of business just from the TRT process, but I can understand that...a lot of commercial fisheries have to manage one hell of a lot of management strategies on top of them, but it seems like there [are] still folks that say...let's have no communication and we'll solve this with our Congressman. You know Congress will bring pressure on NMFS and that's where the decisions are really made." –Researcher*

Thirdly, the Atlantic Large Whale team deals with stocks primarily in the northeastern U.S. Statistically, teams in the northeastern U.S. were significantly less successful than others (Chapter 3), and members perceived these teams as less successful than others (Chapters 2 and 3). As described in Chapter 3, stakeholders believe this region historically has been influenced by politics. There is a general lack of trust in the region by stakeholders from all sides. Some feel NMFS has sided with the fishing industry with regard to marine mammal bycatch. Others do not have faith in the information generated by agency scientists.

*"I think that this is a systemic problem with the Northeast Regional Office. They have their political agenda and that's what they're going to act on...I think the Northeast Region, they're under political pressure to respond to fishermen and I think unlike, certainly to a much greater extent than any other region and perhaps unlike most other regions...they view this Take Reduction Team process as an additive complicating matter for addressing their fisheries issues. Since they've got so many stocks that are over-fished in that area and putting what fishermen consider draconian restrictions on the amount of fish that they can catch, they consider this Take Reduction Team process as a pawn to lessen the objections that they'll get from fishermen, so they will be more likely to comply with the fisheries-related restrictions." –Federal employee*

*"The Northeast generally...puts fisheries on top and the Southeast puts marine mammals on top." –Researcher*

*"And they're using faulty equipment. They won't believe a word we tell them unless it can be backed up by some antiquated science. That's very aggravating. We've had to sue the National Marine Fisheries Service because the data that they are putting in front of us is so opposite of what we see out there on a daily basis that we had to prove to them certain species of fish were not in decline that*

*they're actually more than adequate. And that shouldn't have to happen."* – Fisherman

*"In the Northeast, I view that as...very vulnerable to political influence."* – Researcher

*"I think that NMFS could be less cagey about information. I think that they could be more practical and less driven by what their lawyers are going to say. I think they could be more forthcoming with information."* –State manager

Because of regional politics, some members feel the agency has implemented measures too slowly, which has been detrimental to the marine mammals, especially north Atlantic right whales.

*"It's just been forever and ever and ever. In that situation I think, it's just simply the agency has been at it for so long, they're just looking for time... we're in this supposedly six-month thing that's trailed on to 10, 15, 20 years now."* – Researcher

*"We still keep coming up with stuff. And so to me that means [NMFS] didn't do enough at the outset. [They] didn't do enough initially to reduce bycatch. [They] should have gone further."* –Federal employee

*"My complaint is the agency hasn't taken meaningful enough steps. It's such a politically charged issue for them that they, they're doing something akin to taking off a Band-Aid...Often the Band-Aid will come off but you're causing maximum pain by taking tiny little bits of it off at a time...And I think what happens is right now they're ripping it off one hair at a time, like okay well we'll require this. And we know that's not going to work but that'll be the first step. And then we'll think of this other thing..."* –Environmentalist

*"Large whale is totally different, we're talking about a whole different animal, a whole different approach to what we do to prevent entanglements. I think...from being a fisher-person, we are reluctant to put everything on the table at once because we knew we could be out of business tomorrow if that didn't work. So we*

*sort of fed them a little bit at a time, tweaking things as we went trying to make improvements...If you took the threat away from the fishing industry and you said let's do the best we can as soon as we can and keep fishing, I think we could get the whole thing done a whole lot faster."* –Fisherman

*"I don't think that's what Congress intended for these plans or for these teams, as the purpose of these teams was not something they were supposed to just keep chipping away at this gradually and hopefully come up with an answer."* – Federal employee

*"It is mind-numbingly perverse to see the extent of fisheries mortality that has been well documented in endangered large whale species being managed under a decadal, wait and see, plan."* –From survey comments

## **4.5 Take Reduction Plan Implementation**

### **4.5.1 Double-Check the Enforceability Before Voting on an Action or Regulation**

Regulated parties have little incentive to comply with regulations that cannot be enforced (Asmustis-Silvia, 2009; Cox et al., 2007; Gunningham, 2009). Recognizing that there are contextual factors during negotiations that may hamper the following, I recommend that during Take Reduction Team meetings, the agency try to ensure that bycatch mitigation regulations created by the teams are enforceable prior to the consensus vote. One way to facilitate this approach is to require the presence of a member of the Office of Law Enforcement and the Office of General Counsel at every Take Reduction Team meeting in which plans will be created or amended. As discussed above (4.3.5), coordination with other agency divisions is important to ensuring the

creation, implementation, and monitoring of effective Take Reduction Plans. This would require coordination at higher levels within NOAA. In the interest of streamlining existing Take Reduction Plans, teams should consider eliminating current unenforceable regulations that are ineffective.

*"If the government is present during the negotiations, one of their key roles in those negotiations is to ensure that what is developed is enforceable. That's their job. And then, once the plan becomes law, their job is to enforce it." –Facilitator*

*"It's definitely enforcement and...always better communication between the agency and the stakeholders of what will work and what won't work. It's hard when you think you're coming up with effective measures and then the agency's legal teams get a hold of it and say no, you can't say that or we would have to interpret it like this." –Environmentalist*

*"I think that one of the roles of a good facilitator is to ask clarifying questions and one question could be well, is that enforceable? I think that the facilitator, still within the bounds of neutrality, can ask good questions about scientific rationale and implementation feasibility and I would say that enforcement is a subset of implementation feasibility." –Facilitator*

*"I think when you don't have enforcement you don't get compliance... when you have depth of set or length of duration of set, those kinds of requirements can't be enforced and therefore you're relying on voluntary compliance... You have to have a regulation and you have to enforce it because voluntary compliance doesn't work... look at the dynamic management stuff for speed. Over and over, we've got multiple papers showing that in the dynamic management areas, they don't slow down, because you can't do anything to them. It's voluntary." – Environmentalist*



## **4.5.2 Provide Support for Testing the Effectiveness of Gear Modifications**

As discussed in Chapter 3 and Section 4.3.5 above, determining effective mitigation measures is difficult in the absence of compliance and enforcement monitoring. When feasible, NMFS should leverage its relationships and coordinate with private entities and foundations to encourage and support studies to test the effectiveness of gear modifications or new technologies. Results will then indicate the potential effectiveness of these mitigation measures under ideal conditions.

*"Some of these mitigation measures that we've talked about on some of the teams, they just don't have the funding to experiment with them. I think there are a number of instances where some further research on weak hooks and testing them is needed. I think ... if you're going to rely on length of longlines as a mitigation measure, then there should be some testing done to figure out a way to monitor compliance without having to send boats."* –Federal employee

## **4.5.3 Minimize Agency Actions That Will Undermine Take Reduction Plan Implementation**

### **4.5.3.1 Eliminate from Take Reduction Plans, the "Other Special Measures" or similar provisions that have the potential to undermine team decisions**

As a result of recent agency actions, the Harbor Porpoise team transformed from a model of successful Take Reduction planning to a team that is polarized, and apparently now unable to achieve consensus. The team has lost longtime members who had built trust and created social capital (Chapter 3). The Northeast Regional Administrator (John Bullard) undermined the consensus-based Take Reduction Plan by

invoking a stipulation of the plan called the "Other Special Measures Provision" (50 CFR 229.34(d)). This provision allowed NMFS to alter plan requirements without convening the team or requiring consensus. The agency has modified the language to require the NMFS to consult with the team prior to using the provision, but does not require a consensus agreement (50 CFR 229; 78 FR 61821). The agency, thus, would retain the authority to overturn a consensus-based regulation created by the team and is merely obligated to consult with the team prior to doing so. One point of agreement of Harbor Porpoise team members since the "Bullard decision" was to sunset the "Other Special Measures Provision" from the Harbor Porpoise Take Reduction Plan (CONCUR, 2013b). I recommend the agency remove this or any similar provision from all Take Reduction Plans. If the agency has the ability to undermine the consensus-based decisions created by the team (even in consultation with the team), then members will lose any existing trust in the agency and faith in the Take Reduction Planning process.

*"Consensus was hard-won and so when a consensus decision is then not carried out, the expectation is that it will come at a fairly high price."* –Facilitator

*"And then the Regional Administrator stepped in...and kind of superseded the TRT process and promulgated different rules than the Take Reduction Team had agreed to. And so that really was the unraveling of that one. We had Take Reduction Team members that resigned. It got pretty adversarial pretty quick... the Harbor Porpoise team now...members are going to become more entrenched in their positions."* –Fisheries manager

*"They took something that worked and broke it on purpose. I don't see it being fixed."* –Environmentalist

*"Well I think one of the ways in which the Take Reduction planning process could be improved is if the agency took a stronger stance in agreeing to eliminate political interference. So if Regional Administrators and the Assistant Administrator said we will - as much as we can - abide by the decision of the Take Reduction Teams and we will not make decisions that affect the Take Reduction planning process without the agreement of the Take Reduction Teams, I think that's the one thing that would improve the process. And that would mean that team members would have to work harder at the table and spend less time going outside the process to subvert it."* –Researcher

#### **4.5.3.2 Ensure support from agency leadership**

Support from agency leadership conveys to members that the agency believes in the process, feels it is important, and will not undermine the teams' consensus-based decisions. In turn, this should improve trust and confidence in the agency by the membership. Support at higher levels in NOAA also will facilitate intra- and inter-agency cooperation, compliance monitoring, and enforcement. Young (2001) made this recommendation based on early reviews of the process and all of her arguments hold true today.

*"Leadership support within the agency, I think, is the number one thing. The Fishery Management Council process has the involvement of the Regional Administrator and the Center Director of every single region, at every single meeting, and I never saw that level of support for the TRTs. So if the agency doesn't take it seriously, the fishermen aren't going to take it seriously. So I think when you started to see General Counsel show up, enforcement show up, occasionally the Regional Administrator show up, I think people started to take it*

*a little bit more seriously, but when you have a Regional Administrator that decides to back off on regulations that were agreed to by consensus, you really harm the process.” –Federal employee*

Data collected by the observer program is critical to the creation and successful implementation of Take Reduction Plans. The NMFS extrapolates bycatch and compliance rates from the observer data, and relies greatly on descriptions by observers of marine mammal interactions with fishing gear. These descriptions are critical for the team and agency to devise safe methods of disentanglement and for devising creative gear modifications or other solutions to mitigate those interactions. Close coordination between the Office of Protected Resources and the observer program should occur at the highest levels within the agency to ensure that the observer data are being used consistently across regions and to minimize data lags.

*“Having a strong relationship between the observer program and the Take Reduction Team coordinator in terms of mobilizing information and being available not only to make presentations, but perhaps give comments on the feasibility of different options, and really having the observer team understand the Take Reduction Team process. That really seems like an asset as well.” – Facilitator*

#### **4.5.3.3 Minimize agency delays in disseminating research results and rulemaking, and be forthright about timelines to team members**

Several stakeholders have voiced frustration over the time-lags between when fishing, bycatch, and stock assessment data are collected and verified, versus when they

are disseminated to members. Often teams are making decisions based on data that may be the best available, but are a few years old. Fishing effort can change in the interim, making the consensus agreements obsolete as soon as they are made. When possible, NMFS should expedite the turn-around time on research results. Again, to facilitate this would require support and cooperation of agency leadership.

*"It would be great to figure out how to really accelerate the turn-around of scientific research and its availability to the team. And I know that's something that there's really kind of bipartisan interest in that."* –Facilitator

*"It's amazing how cumbersome their process is, their review process. Everything they have to go through. Every year, NMFS puts out an analysis of the entanglement and ship strike of large whales and there's like a 4-year time-lag on that..."* –State manager

*"So there would be a good plan that would come out ... and then you'd end up with delays in implementation. Implementation, but no enforcement, and then, again delays between when you could reconvene the team because you see that you're not meeting the mark. And then the team gets together and it essentially comes up with additional measures. Again, you're back to delays...And so there wasn't kind of this quick, iterative process that was envisioned when the law was put together and that's really hurt the team...they're all meant to fit together like a set of gears and when one doesn't move, then the other ones tend to not function well."* –Environmentalist

As described above (Section 4.3.1), scheduling Take Reduction Team meetings in a way to minimize the demands on agency researchers who serve multiple teams could also increase efficiency and minimize turn-around times.

*“I think it’s really hard when you have a number of teams in the Atlantic for example, that are relying on the same scientists to analyze data and give you what you need to hold a team meeting. It’s hard to have that all happen at the same time.” –Federal employee*

Despite the very tight (and unrealistic) deadlines of the MMPA (GAO, 2008), lag times occur between the time the team agrees to plan amendments and when those rules are implemented. These lag times, referred to as the “ossification” of the rulemaking process, are the unintended consequence of efforts by all three branches of government to increase agency transparency and accountability (McGarity, 1992; Susskind and McMahon, 1985). Rulemaking delays postpone their intended benefits (Balla and Wright, 2009), in this case increased protections for marine mammals. For example the Harbor Porpoise team amended their plan in 2007, but those amendments were not implemented until 2010. In the interim, fisheries management in New England was transformed into Sectors, which likely impacted those amendments. One way to streamline the rulemaking process is for NMFS to continue to encourage the Take Reduction Teams to create detailed regulatory language during the meetings. This would minimize confusion and delays when agency staff must translate the consensus-based agreement into regulatory language, and was successfully implemented by the EPA in the mid-1980s (Susskind and McMahon, 1985). This minimized the number of public comments received by the EPA, which had the added benefit of saving time.

*“I would say that the more detailed a plan [the agency gets] from a team, the easier the rulemaking process is... and the faster it goes. So if a team gives something ... ambiguous, and then [the agency is] trying to figure out all of the different possibilities and how this goes through the entire fishery management process and ESA, and MMPA, and NEPA ... and economically what does it mean? The more detailed stuff [the team provides] the easier it will make [the] analysis and the faster the process will go...The complexity matters.”—Federal employee*

In addition, NMFS should be forthright with the members about the delays of rulemaking. This would minimize members' expectations of fast turn-around times, which could increase trust in the agency and minimize hostility and frustration. In their initial survey of Take Reduction Team members, RESOLVE (1999) found that 60% of the respondents were dissatisfied with the plans because of agency delays in rulemaking.

*“I think the agency almost needs to come and say this is really feasibly how long it's going to take for us to complete this and get it through clearance process and then get it back. So knowing that, it would help and it would also help, I think that's something that has to be seriously looked at if anybody ever picks up the MMPA to amend it again. It all goes to, I don't want to get on all of the other things they need to amend in that section, but that's kind of the biggest one, is the timetable and the expectation.”—Environmentalist*

*“So it's the nature of the beast, but maybe setting those expectations from the beginning – saying yes, we really want your input and it's important for us to get it done quickly because this process is a long process, and make sure they know that so the expectation isn't that they're just going to see regs within the next month... and maybe laying out and communicating what that process looks like...because the NGOs have sued over slow implementation. And that, I think, has been good actually, to get the resources focused back on getting those regs out because complacency is the number one problem within the government. There are just too many crises, too many things that people are working on. You just got to get it done, get it done.”—Federal employee*

## ***4.6 Future Evaluations***

### **4.6.1 Periodically Evaluate Ecological Success Using the Ecological Ranking Method**

"Why don't we apply science more frequently in evaluation? Did the intervention achieve what it claimed? Why or why not?" (Burchfield, 2001, p. 241). In addition to addressing these questions, MMPA mandates and the substantial human and economic costs incurred by marine mammal take reduction planning support evaluation of its ecological effectiveness (Koontz and Thomas, 2006; Newig, 2007; Weiss, 1972). Fortunately, the challenges of gathering and analyzing long-term monitoring data have been overcome; marine mammal Stock Assessment Reports provide useful tools with which to evaluate take reduction planning. The formulas for Metrics 1 and 2 to evaluate the ecological effectiveness of marine mammal Take Reductions Plans are straightforward and easy to replicate. The required information is included in the annual Stock Assessment Reports. I recommend that NMFS periodically (every five years or as necessary) evaluate the ecological effectiveness of the plans using the formulas provided in Chapter 1. These evaluations can be incorporated into the agency's take reduction Monitoring Strategies. As information becomes available, it will be particularly important to conduct the analyses for the False Killer Whale plan and for additional stocks of the Bottlenose Dolphin plan. Moreover, the agency should convey



the results to the Take Reduction Team members so that if necessary, they can amend their plans in response.

#### **4.6.2 Periodically Survey Members**

Regarding the social evaluation, I recommend the agency or a neutral third party periodically survey current Take Reduction Team members about their views of the Take Reduction planning process. In addition to questions about the negotiation process, outputs, and outcomes, the survey should include questions about compliance and enforcement. Using the current study as a baseline, it would be interesting to see if opinions change, especially if the agency implements any of the recommendations in this document. Because actual ecological success affects perceived success, it follows that if the teams have reduced bycatch, the members will be more optimistic about Take Reduction planning, which should improve buy-in of all members.

#### **4.7 Conclusions**

It has been 20 years since marine mammal Take Reduction Planning was incorporated into the MMPA. Early evaluations were promising, but identified several challenges (RESOLVE, 1999; Young, 2001). In the past decade or more, NMFS has implemented measures to set up the teams for success. Although actual and perceived ecological outcomes have varied across teams, the process has the essential ingredients

for successful multi-stakeholder negotiations. The recommendations described here are based upon the ecological and social evaluations described in this dissertation. If NMFS implements these suggestions, both perceived and actual ecological effectiveness of marine mammal Take Reduction Teams should improve, allowing these teams to achieve their full potential.

## Appendix A: Structural Equation Models

Structural Equation Models (SEMs) provide a framework to examine correlated variables in terms of cause and effect. They calculate relationships among variables using a combination of path analysis, multiple regression analysis, and factor analysis (Bollen 1989). SEMs are composed of two sets of models – the latent variable model and the measurement model (Bollen 1989). Latent variables are characteristics that cannot be measured directly, but are comprised of a combination of variables that can be directly measured (called “observed effect” or “measurement” indicators). An example of a latent variable in ecology would be ocean health, while an example in the social sciences would be economic health. Ocean or economic health is typically assessed using a combination of several measurable indicators that are monitored over time.

There are two types of latent variables – endogenous and exogenous. Endogenous latent variables are determined within the model and represent the effect of one latent variable on another. Exogenous latent variables, on the other hand, are not explained by the model, but rather determined outside the model by the exogenous indicators (Bollen 1989). The general structural equation for the latent variable model is essentially a regression equation (Bollen 1989).

Measurement models relate the measured or observed effect indicators to the latent variables, and contain variables that explain either endogenous or exogenous

latent variables (Bollen 1989). In this study, the measurement indicators are the responses to the survey questions. Measurement model equations are factor analysis equations (Bollen 1989). The factor loadings ( $\lambda$ ) indicate the direct effects of the latent variables on the observed variables (Bollen 1989). They are, “the magnitude of the expected change in the observed variable for a one unit change in the latent variable” (Bollen 1989, p. 17). The model also calculates a squared multiple correlation coefficient for each measurement indicator ( $r^2$ ). This value reflects the amount of variance in the measurement indicator that is accounted for by the latent variable, and also measures the reliability of the measurement indicators/survey questions (see below). Variables in both the structural and measurement models can be correlated, as can their disturbances.

Finally, independent covariates can be used to clarify either observed effect indicators or latent variables. According to Bollen and Bauldry (2011, p. 266), “covariates are variables that are not measures of a latent variable, but they are nonetheless important to include to avoid biased estimates of the relations between latent variables and indicators.” Covariates can directly influence the latent variable without being causal indicators because their impacts are less influential (Bollen and Bauldry, 2011). Causal indicators, on the other hand, “correspond to the theoretic definition of the latent variable... are hypothesized to cause changes in” the latent variable, and their effects

should be relatively stable (Bollen and Bauldry, 2011, p. 269). Mathematically, there is no difference between covariates and causal indicators - the latent variable is regressed on both types of variables. The investigator determines whether or not the variable is a covariate or causal indicator by deciding if it is theoretically related to the latent variable (Bollen and Bauldry, 2011). In this study, covariates include Take Reduction Team identity, age, and size, stakeholder affiliation, and U.S. geographic region. Because the covariates are dummy variables (categorical variables), the regressions are essentially ordered Probit equations (Muthén and Muthén, 1998-2010). The model also calculates the squared multiple correlation coefficients ( $r^2$ ) for each latent variable. This value is the amount of variance in the latent variable that is accounted for by the covariates and in the case of endogenous latent variables, the variance accounted for by other latent variables.

SEMs are calculated by simultaneous, linear equations that represent a hypothesis about the relationships (covariances or correlations) among the observed and latent variables (<http://faculty.ucr.edu/~hanneman/soc203b/lectures/identify.html>). The equations consist of known and unknown parameters. The known parameters can be estimated, in this case, by using the WLSMV. We may or may not be able to estimate the unknown parameters (Bollen, 1989). To solve the simultaneous equations, we must have enough information to estimate each unknown parameter. One way to solve for

unknown parameters is to write each unknown parameter as a function of the known parameters. In addition, these functions must lead to a unique solution (Bollen, 1989). If a value for one or more unknown parameters cannot be calculated, the model is unidentified and model fit cannot be calculated. If there is only one way to solve for each unknown parameter (all parameters are identified), the model is perfectly identified and again, model fit cannot be calculated. If there is more than one way to solve for at least one unknown variable, that parameter is over-identified and therefore, the model is over-identified and model fit can be tested (Bollen, 1989).

## Appendix B: Survey Code Book

**TRT** Please indicate all TRTs of which you are/were a participant or facilitator (check all that apply). Please answer the appropriate block for every TRT on which you serve(d). The block number for each team is listed next to the team name.

<b>ALWTRT</b>	Atlantic Large Whale Take Reduction Team (ALWTRT) – <u>go to Block 1</u>
<b>ATGTRT</b>	Atlantic Trawl Gear Take Reduction Team (ATGTRT) – <u>go to Block 2</u>
<b>BDTRT</b>	Bottlenose Dolphin Take Reduction Team (BDTRT) – <u>go to Block 3</u>
<b>FKWTRT</b>	False Killer Whale Take Reduction Team (FKWTRT) – <u>go to Block 4</u>
<b>HPTRT</b>	Harbor Porpoise Take Reduction Team (HPTRT) - includes the former Gulf of Maine and Mid-Atlantic Harbor Porpoise TRTs – <u>go to Block 5</u>
<b>POCTRT</b>	Pacific Offshore Cetacean Take Reduction Team (POCTRT) – <u>go to Block 6</u>
<b>PLTRT</b>	Pelagic Longline Take Reduction Team (PLTRT) – <u>go to Block 7</u>
<b>AOCTRT</b>	Atlantic Offshore Cetacean Take Reduction Team (AOCTRT) - disbanded in 2001 – <u>go to Block 8</u>

**AFFIL** I represent(ed) the following sector(s) at the negotiation table of the \_\_\_\_ Take Reduction Team meetings (check all that apply).

<b>RES</b>	Academic/scientific community
<b>FISH</b>	Fishing Industry (includes processors)
<b>ENV</b>	Environmental/conservation
<b>STATE</b>	State agency representative
<b>FED</b>	Federal agency representative
<b>FMC</b>	Interstate Fishery Management Council
<b>FACIL</b>	Facilitator
<b>OTHER</b>	Other. Please specify _____

Please select the number of \_\_\_\_ Take Reduction Team meetings and/or webinars you have attended

<b>MEETINGS</b>	
<b>1</b>	None
<b>2</b>	1-3
<b>3</b>	4 or more

**If None Is Selected, Then Skip To End of Block**

Please indicate how much you agree or disagree with the following statements. N/A = not applicable.

After participating in the <u>TRT</u> , I have...								
<b>SOCAP</b>	<b>1</b> Strongly disagree	<b>2</b> Disagree	<b>3</b> Neither disagree nor agree	<b>4</b> Agree	<b>5</b> Strongly agree	<b>6</b> I Don't Know	<b>7</b> N/A (Please Explain in Comments)	Comments (optional)
<b>NEWVIEWS</b> ...a better understanding of viewpoints of other members of the <u>TRT</u>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>NEWKNLFISH</b> ...a better understanding of the biological/ecological information about the fisheries discussed by the <b>TRT</b> .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>NEWKNLBC</b> ...a better understanding of the biological/ecological information about marine mammal bycatch discussed by the <b>TRT</b> .	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>NEWFRIENDS</b> ...established new, long-term professional or personal relationships with team members who have differing viewpoints from my own.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	



During the \_\_\_\_ Take Reduction Team meetings...

	1	2	3	4	5	6	7	
<b>FAIR</b>	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	I Don't Know	N/A (Please Explain in Comments)	Comments (optional)
<b>MYVIEWS</b> ...I am given the opportunity to express my views.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>MYVIEWSEXP</b> ...I take the opportunity to express my views.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>OTRVIEW</b> ...others are given the opportunity to express their views.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Please indicate how much you agree or disagree with the following statements about the \_\_\_\_ Take Reduction PLAN. N/A = not applicable.

	1	2	3	4	5	6	7	
<b>TRP</b>	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree	I Don't Know	N/A (Please Explain in Comments)	Comments (optional)
<b>TRPVIEW</b> The <u>PLAN</u> incorporates my views	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>TRPBETTER</b> The <u>PLAN</u> is better than if NMFS created its own regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Please indicate how the \_\_\_\_ TRT has impacted the issues below.

OUTCOME	1 Made much worse	2 Made somewhat worse	3 Made slightly worse	4 No Effect	5 Made slightly better	6 Made somewhat better	7 Made much better	8 I Don't Know	Comments (optional)
<b>BC</b> Marine mammal bycatch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>ABUND</b> Abundance of marine mammal stocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>TARGET</b> Catch rates of target species (fish catch)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<b>LVLHD</b> Livelihoods of fishermen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

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## Biography

I was born on 19 September 1968 in Princeton, New Jersey and couldn't wait to leave the cold, so headed south to Duke University where I received a B.S. in Zoology in May 1990. After gaining some work and life experience, I went to the Florida Institute of Technology while also working for the State of Florida doing marine mammal rescue and recovery. I received my M.S. in Marine Biology in May 1996. My master's thesis was on growth rates and suckling behavior of captive Florida manatees. I worked briefly for the National Marine Fisheries Service, but quickly returned to Florida where I worked as a manatee biologist for eight additional years. While there, I wrote a technical report, "A regional assessment of Florida manatees (*Trichechus manatus latirostris*) and the Caloosahatchee River, Florida" and received the Florida Fish and Wildlife Conservation Commission's Excellence in Cooperative Science award. I also received the Sierra Club's Panther and Black Bear Awards for Outstanding Conservation Work and Leadership in Environmental Protection. Prior to matriculating as a doctoral student, I was a project manager at the Duke Marine Lab, then began my doctoral program in Fall 2009. I received the Rethinking Regulation Graduate Research Award and the E. Bayard Halsted Scholarship. I am a member of the American Association for the Advancement of Science, Society for Conservation Biology, and Society for Marine Mammalogy.